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Science and Invention

Can We Control Sex?

By Oscar Riddle, A.B., PH.D.
Carnegie Institute

See Page 682

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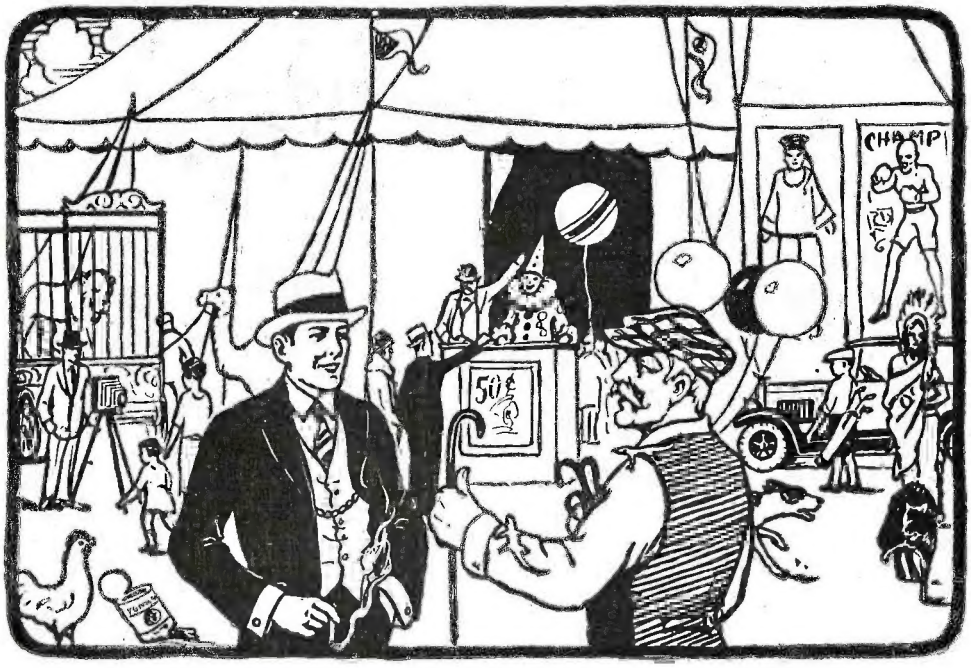
I AM going to give away ABSOLUTELY FREE, more than $5,000.00 worth of wonderful prizes, consisting of two Automobiles, two Phonographs, a Shetland Pony, a Radio, a Bicycle, Silverware and many other high grade articles of merchandise—besides Hundreds of Dollars in Cash. Already we have given away Thousands of Dollars in Cash and Valuable Prizes to advertise our business, but this is the most liberal offer we have ever made. First Prize winner will receive an 8 Cyl., 100 Horsepower, Custom Built Studebaker Sedan or $2,250.00 in cash; Second Prize Winner will receive a Four-door Chevrolet Sedan or $675.00 in cash; Third Prize Winner will receive a Victor Orthophonic Victrola, Model 84, or $235.00 in cash, etc. Each Prize will be shipped and delivered right to the winner's door, all charges paid. This offer is open to anyone living in the United States, outside of Chicago, and is backed by a Big Reliable Company of many years' standing.



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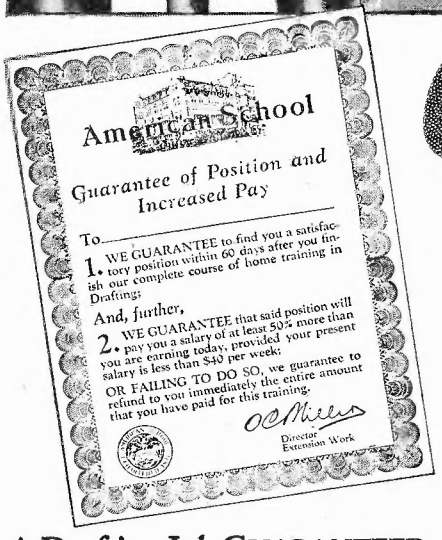
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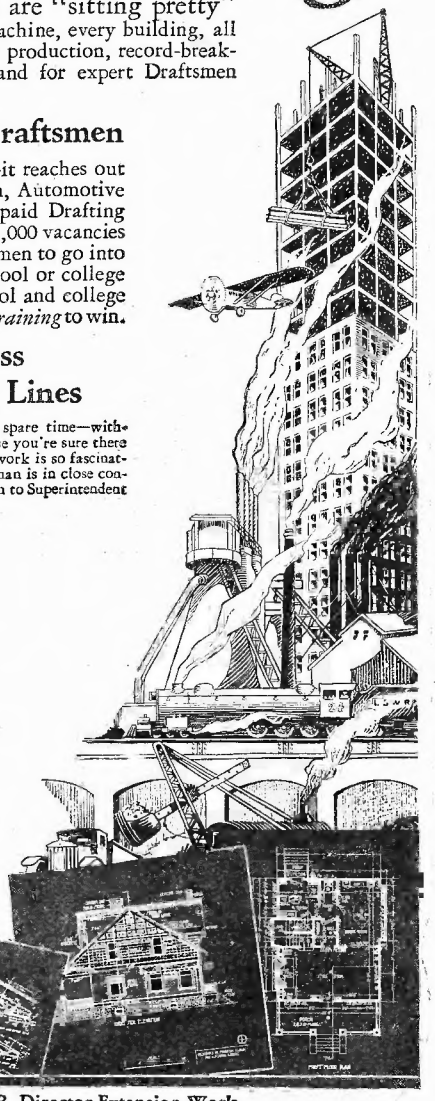

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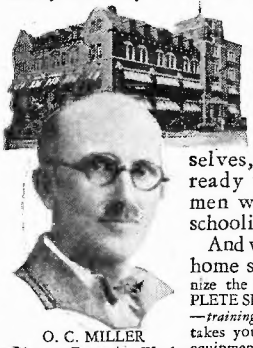

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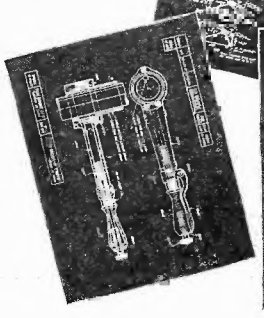

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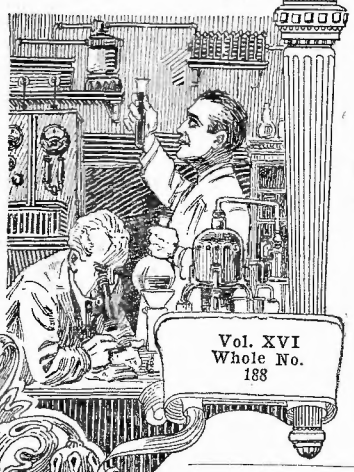

Vol. XVI
Whole No.
188

Science and Invention

DECEMBER
1928
No. 8

Formerly ELECTRICAL EXPERIMENTER
COMBINED WITH "THE EXPERIMENTER"

EDITORIAL, ADVERTISING AND GENERAL OFFICES:
230 Fifth Avenue, New York City

Published by Experimenter Publishing Company, Inc. H. Gernsback, Pres.; S. Gernsback, Vice-Pres. and Treas.; Irving S. Manheimer, Sec'y

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SCIENCE AND INVENTION is published on the 10th of each month. There are 12 numbers per year. Subscription price is $2.50 a year in U. S. and possessions. Canada and foreign countries, $3.00 a year. U. S. coin as well as U. S. stamps accepted (no foreign coin or stamps). Single copies, 25c each. All communications and contributions to this journal should be addressed to Editor, SCIENCE AND INVENTION, 230 Fifth Ave., New York City, N. Y. Unaccepted contributions cannot be returned unless full postage has been included. ALL accepted contributions are paid for on publication. SCIENCE AND INVENTION Monthly. Entered as second-class matter May 10, 1924, at the Post Office at New York, N. Y., under the act of March 3, 1879. Additional entry at Dunellen, N. J. and San Francisco, Calif. Title Registered at the Patent Office.

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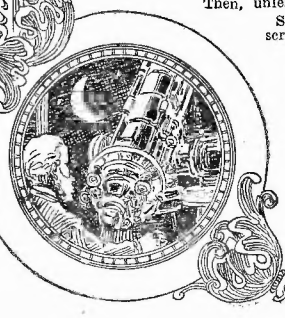

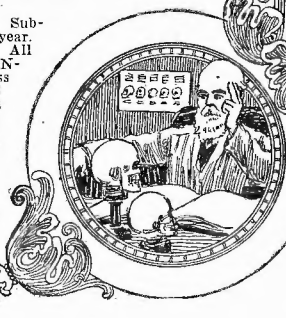

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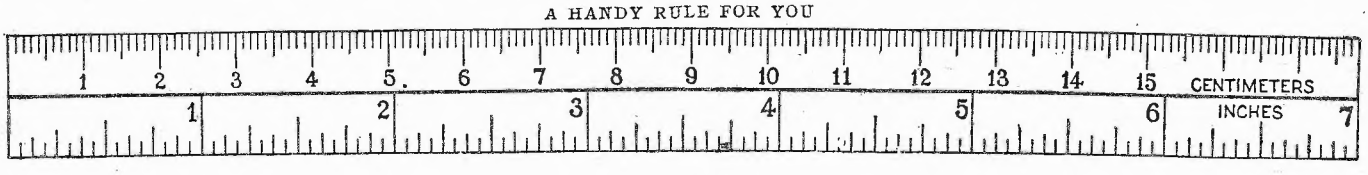

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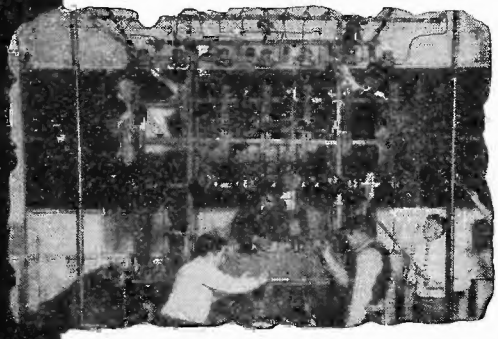

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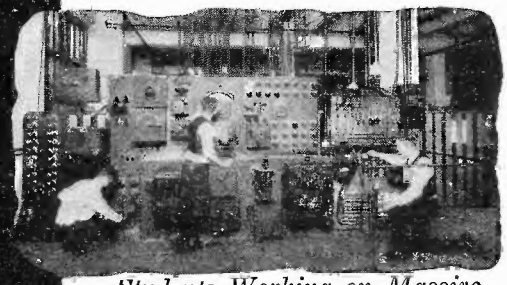

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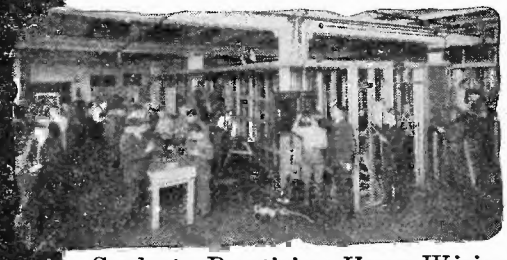

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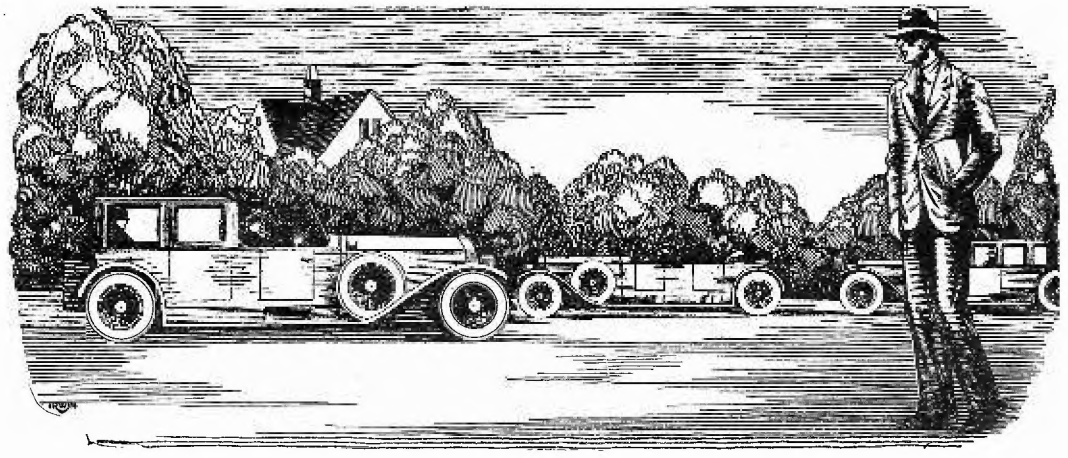

Many times in the old days, while I trudged home after work to save carfare, I used to gaze enviously at the shining cars gliding by me, the prosperous men and women within. Little did I think that inside of a year, I, too, should have my own car, a decent bank account, the good things of life that make it worth living.

I Thought Success Was For Others

Believe It Or Not, Just Twelve Months Ago I Was Next Thing To "Down-and-Out"

TODAY I'm sole owner of the fastest growing Radio store in town. And I'm on good terms with my banker, too—not like the old days only a year ago, when often I didn't have one dollar to knock against another in my pocket. My wife and I live in the snuggest little home you ever saw, right in one of the best neighborhoods. And to think that a year ago I used to dodge the landlady when she came to collect the rent for the little bedroom I called "home"!

It all seems like a dream now, as I look back over the past twelve short months, and think how discouraged I was then, at the "end of a blind alley." I thought I never had had a good chance in my life, and I thought I never would have one. But it was waking up that I needed, and here's the story of how I got it.

I WAS a clerk, working at the usual miserable salary such jobs pay. Somehow I'd never found any way to get into a line where I could make good money.

Other fellows seemed to find opportunities. But—much as I wanted the good things that go with success and a decent income—all the really well-paid vacancies I ever heard of seemed to be out of my line—to call for some kind of knowledge I didn't have.

And I wanted to get married. A fine situation, wasn't it? Mary would have agreed to try it—but it wouldn't have been fair to her.

Mary had told me, "You can't get ahead where you are. Why don't you get into another line of work somewhere that you can advance?"

"That's fine, Mary," I replied, "but *what* line? I've always got my eyes open for a better job, but I never seem to hear of a really good job that I can handle." Mary didn't seem to be satisfied with the answer, but I didn't know what else to tell her.

It was on the way home that night that I stopped off in the neighborhood drug store, where I overheard a scrap of conversation about myself. A few burning words that were the cause of the turning point in my life!

With a hot flush of shame I turned and left the store, and walked rapidly home. So that was what my neighbors—the people who knew me best—really thought of me!

"Bargain counter sheik—look how that suit fits," one fellow had said in a low voice. "Bet he hasn't got a dollar in those pockets." "Oh, it's just 'Useless' Anderson," said another. "He's got a wish-bone where his backbone ought to be."

As I thought over the words in deep humiliation, a sudden thought made me catch my breath. Why had Mary been so dissatisfied with my answer that "I hadn't had a chance?" *Did Mary secretly think that too?* And after all, wasn't it *true* that I had a "wish-bone" where my back-bone ought to be? Wasn't that why I never had a "chance" to get ahead? It was true, only too true—and it had taken this cruel blow to my self-esteem to make me see it.

With a new determination I thumbed the pages of a magazine on the table, searching for an advertisement that I'd seen many times but passed up without thinking, an advertisement telling of big opportunities for trained men to succeed in the great new Radio field. With the advertisement was a coupon offering a big free book full of information. I sent the coupon in, and in a few days received a handsome 64-page book, printed in two colors, telling all about the opportunities in the radio field and how a man can prepare quickly and easily at home to take advantage of these opportunities. I read the book carefully, and when I finished it I made my decision.

WHAT'S happened in the twelve months since that day, as I've already told you, seems almost like a dream to me now. For ten of those twelve months, *I've had a Radio business of my own!* At first, of course, I started it as a little proposition on the side, under the guidance of the National Radio Institute, the outfit that gave me my Radio training. It wasn't long before I was getting so much to do in the Radio line that I quit my measly little clerical job, and devoted my full time to my Radio business.

Since that time I've gone right on up, always under the watchful guidance of my friends at the National Radio Institute. They would have given me just as much help, too, if I had wanted to follow some other line of Radio besides building my own retail business—such as broadcasting, manufacturing, experimenting, sea operating, or any one of the score of lines they prepare you for. And to think that until that day I sent for their eye-opening book, I'd been wailing "I never had a chance!"

NOW I'm making real money. I drive a good-looking car of my own. Mary and I don't own the house in full yet, but I've made a substantial down payment, and I'm not straining myself any to meet the installments.

Here's a real tip. You may not be as bad off as I was. But, think it over—are you satisfied? Are you making enough money, at work that you like? Would you sign a contract to stay where you are now for the next ten years, making the same money? If not, you'd better be *doing* something about it instead of drifting.

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Take another tip—No matter what your plans are, no matter how much or how little you know about Radio—clip the coupon below and look their free book over. It is filled with interesting facts, figures, and photos, and the information it will give you is worth a few minutes of anybody's time. You will place yourself under no obligation—the book is free, and is gladly sent to anyone who wants to know about Radio. Just address J. E. Smith, President, National Radio Institute, Dept. 44-T, Washington, D. C. and the book will be mailed the same day your coupon reaches him—you can have it right in your hands in a few days if you mail the coupon now.

J. E. SMITH, President,
National Radio Institute,
Dept. 44-T, Washington, D. C.

Dear Mr. Smith:

Please send me your 64-page free book, printed in two colors, giving all information about the opportunities in Radio and how I can learn quickly and easily at home to take advantage of them. I understand this request places me under no obligation, and that no salesmen will call on me.

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"I got the job! Three and one-half hours after your recommendation must have reached Mr. A—— I was called in to his office and promoted over heads of at least twelve men." (Signed) *J. J. Kelly.*

"I am now cleaner and dyer for the above-named company, and I believe that the course which I am taking with you is the cause of my getting this place. My salary is almost double what it was when I started with the course." (Signed) *E. H. Lasater.*

"I thought I would write and let you know of my success. I now have a fine position as chemist at Du Pont's Dye Works. It was through your course alone that I have been so successful." (Signed) *B. G. Bennett.*

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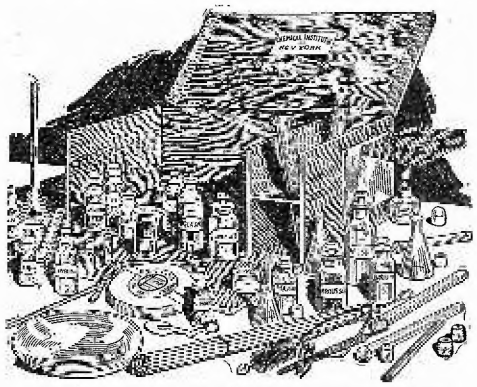

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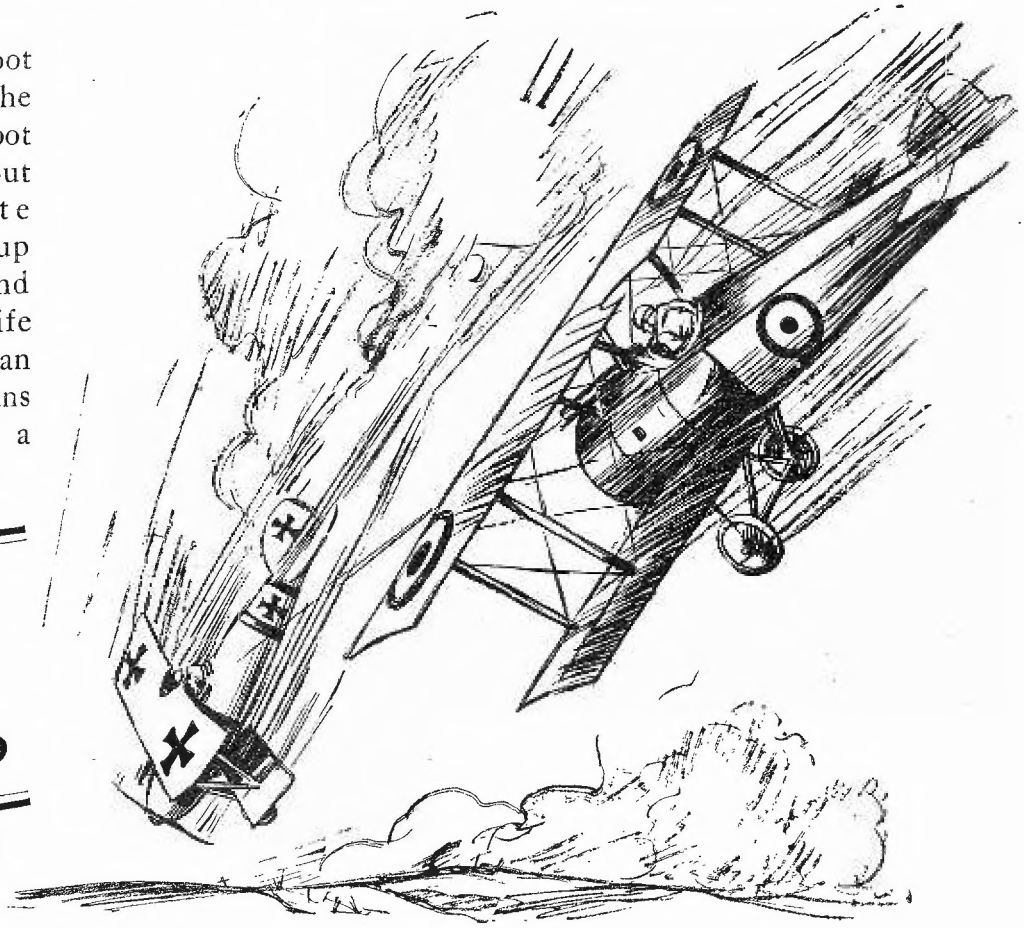

Zooming Into a Death Trap

By Raoul Whitfield

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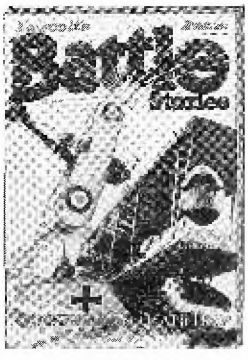

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It is prophesied that man will eventually be able to control the rearing of male or female offspring at will

Control SEX?

RIDDLE, A. B., Ph. D.

Station for Experimental Evolution

Sex can now be definitely predetermined in birds.

A SERIES

"The Gorilla," by Frémiet, has a different significance when we note this: ". . . mates so dissimilar as dove and pigeon would have to be sought by humans among the gorillas and Chimpanzees."

jingo chorus is often strengthened by the circumstance that many newspapers and newspaper writers—in response to the mental declination of their readers—often so dress, twist and garble the statements of competent scientific writers as to have it appear that marvelous changes already have been effected experimentally in the sex of human beings.

IN an effort to ascertain, in a strictly scientific manner, whether it is possible for us to control sex at will, SCIENCE AND INVENTION *Magazine has undertaken to publish a series of three articles, the first of which appears in the present issue. The other articles will be published in the January and February issues.*

SCIENCE AND INVENTION *has been fortunate in securing the latest scientific discoveries and data on this topic from the greatest scientists on this subject in this country. Much that is new will be found in these articles, which have been prepared with the idea uppermost in mind, that they should be presented in a straightforward manner and in non-technical language.*

There has been a great deal of controversy on the subject. There has been a tremendous amount of misinformation and superstition, and charlatans in the past have exploited the unwary to a marked degree.

In addition, a questionnaire, printed elsewhere, has been sent to 587 *of a selected list of well-known physicians, obstetricians and scientists whose work makes them familiar with this more than interesting topic. Their findings on the question,* "Can We Control Sex?" *will be printed in subsequent issues.*

It is quite certain that these articles will be the most outstanding ones that have ever been published anywhere.

Much Fiction in Sex Control

FOR a moment we may focus on some of the current products of such unscientific writers. One swollen volume is devoted to the view that the egg-cell of the human assumes two states or conditions, each of which—like the ebb and flow of the tide—is under the influence of the moon; and that one sex results if the plastic egg is fertilized at the ebb-tide, the other sex when fertilization occurs during flow-tide. Another writer is less careful about the time of day, but more careful about *which* day. In the functional lunar month of woman this authority thinks that sex may be controlled by observing the following rules: Consider the period of woman's indisposition as lasting always five days whether or not it does so in fact. Sperm uniting with an egg on the first and second days preceding this period, and on the first and second days succeeding it, will produce girls. But fertilizations occurring on the third, fourth and fifth days preceding, and on the fourth, fifth, sixth, seventh and eighth days after, the period are said to produce boys. In still a third recent volume we are told that it is the amount of sunlight falling upon the parents that settles all concerning the sex of the offspring in the human. We quote one sentence: If the father has been effectively subjected to sunlight in excess of the mother's subjection, theoretically the child will be female; and if the conditions be reversed a male will result.

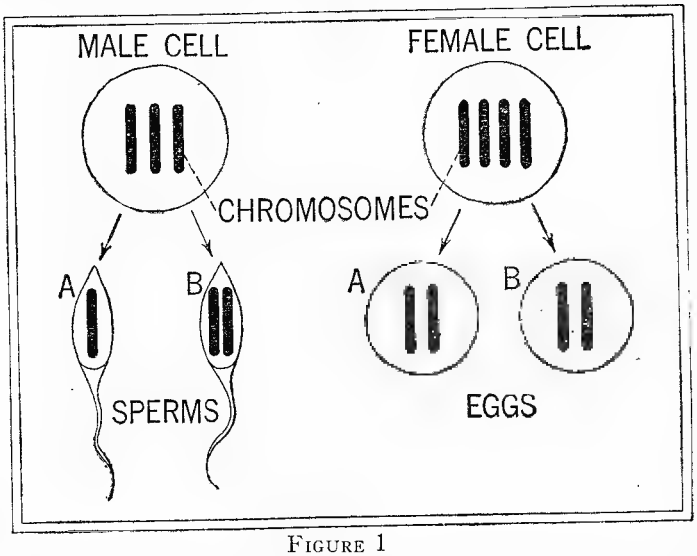

FIGURE 1

This diagram explains how two different kinds of sperms arise from a mother cell. The mother cell originally had an odd number of chromosomes. The sperms must, therefore, get either an even or an odd number from the division. When a sperm with an odd number of chromosomes joins a female cell, the sex of the offspring is different than when one with an even number joins a similar cell.

Male Sperms Cause in Some Cases

WITH the eyes of science—eyes trained adequately to test and to retest observations and experiments—let us have a look at the way in which sex is normally determined. Everybody knows that males produce sperms, and that these are cells. And we all know that females produce ova, or egg-cells, and that even human females are in no wise an exception to this rule. About 25 years ago we began to learn that the males of some animals—humans, dogs, frogs and grasshoppers—manufacture two kinds of sperms. The females of these same species of animals turn out only one kind of eggs. When we say that two kinds of sperms are produced we mean that at every division of cells which results in the formation of two sperms something happens to make the two sperms different. They are made different very regularly, and very simply, in the way shown in Figure 1. The mother cell has an odd number—such as 3, 5, 9—of bodies called "chromosomes"; and the

(*Continued on next page*)

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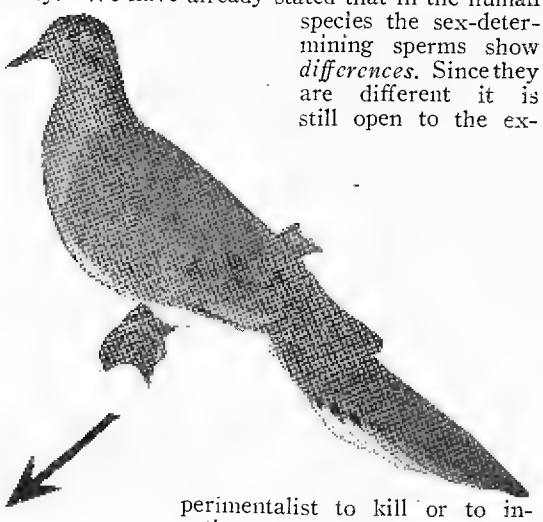
Can We Control Sex?

(Continued from page 683)

two sperms which arise from it get, and must get, unequal numbers of these bodies. This tells us how two different kinds of sperms arise, and explains also why they exist in equal numbers. The last cell-division which gives rise to the eggs, however, does not carry unequal, but equal, numbers of these chromosomes into the two newly formed eggs. All of these eggs have the same number of chromosomes. Now, the sex we shall get from the union of a sperm and an egg will normally depend simply upon the type of sperm which unites with the egg. If a sperm of type *A* unites with the egg, just say that this (ordinarily) settles the question—a male will result from the further growth of this union of cells. But if a sperm of type *B* unites with the egg, and no special or very extraordinary conditions are thrown about that union of cells, then a female will be hatched or born.

Fig. 3. The common American mourning and the blonde ring dove which, when mated, produce only male offspring. Some of these offspring are natural males; some are sex reversed females. These sex reversed females often have an oviduct as an evidence of their original femininity.

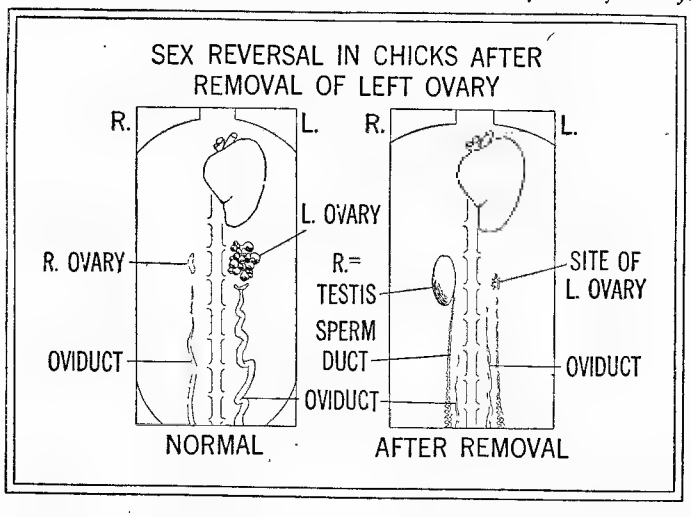


THE YOUNG FROM SUCH PAIRS ARE ALWAYS MALES

We can now treat ourselves to a little variety. In some animals, particularly in birds and butterflies, the males produce only one kind of sperms while the females produce two kinds of eggs. Here the sperms all have the same number of chromosomes. It is now the eggs that differ by one half of them having one more chromosome than the other half. In this case the sex of the developing bird or butterfly normally depends upon which sort of egg is concerned. From these thoroughly tested facts you can form your own conclusions as to the decisiveness of sunlight, of the tide, or of the day of the month.

It will be observed that in chickens, the left ovary functions; the right ovary is dwarfed and diminutive. If the left ovary is removed, the right starts to grow, but instead of developing into an ovary, it develops as a testis. The oviducts atrophy, and a sperm duct develops on both sides.

Fig. 4. The diagram below illustrates the points concerned with sex reversal in chicks through surgical removal of the left ovary.



AT this point in our discussion the thoughtful reader will be tempted to suggest that we have arrived at an answer—sex cannot be controlled. But this would be a very wrong conclusion. Let us for just a moment consider, not a present accomplishment, but a future possibility. We have already stated that in the human species the sex-determining sperms show *differences*. Since they are different it is still open to the experimentalist to kill or to inactivate one kind of sperm at will, and thus remove all chances of the appearance of individuals of one sex. The fact that no one has as yet succeeded in doing this does not at all serve as an argument that it will not later be accomplished.

Some important facts concerning our present power to control sex may now be stated. These facts deal with nothing less than cases in which the experimentalist has been able to override the influence of chromosomal differences and bring about true sex transformation or sex-reversal. As suggested in an earlier statement, this control has been accomplished in specially suitable material—where the experimentalist could properly apply special treatments during very early stages of the developing animal. Frogs and birds get their eggs out to us in a convenient form for these experiments. In these animals sex has been, and is being, often and rather readily controlled. In the frog it has been found that some of the eggs and embryos, which would otherwise produce females, can be made to develop into male tadpoles and frogs by forcing them to undergo their earlier development at temperatures higher than normal. The same thing can also be accomplished in frogs by forcing the eggs to become "overripe" before sperms are allowed to unit with them. On the other hand, some male frogs are transformed into females by forcing them to develop at very low temperatures. Most of these experiments were done in Europe.

All Males, if Desired by Cross Breeding

IN pigeons we have found that we can force some eggs that would normally become females to develop into males instead. This is done merely by seeing to it that the male which provides the sperms used in fertilizing these eggs is an entirely different kind of pigeon. Examples of such a cross-mating are found in the ordinary cage ring dove and a common pigeon (see Fig. 2); or, our wild mourning dove and the ring dove (Fig. 3). All eggs obtained from such cross-matings produce males irrespective of whether the eggs used are of one chromosomal type or the other; those which were originally of the female type have had their sex reversed—controlled. This does not seem a very practical method of controlling sex in the human, since mates so dissimilar as dove and pigeon would have to be sought by humans among the gorillas and chimpanzees.

One other easily described method of changing the sex in birds, even after hatching, will be given. It happens that a young female chicken always has a good left ovary and a minute and disappearing right ovary. If the good left ovary is surgically removed from a chick a few weeks after hatching,

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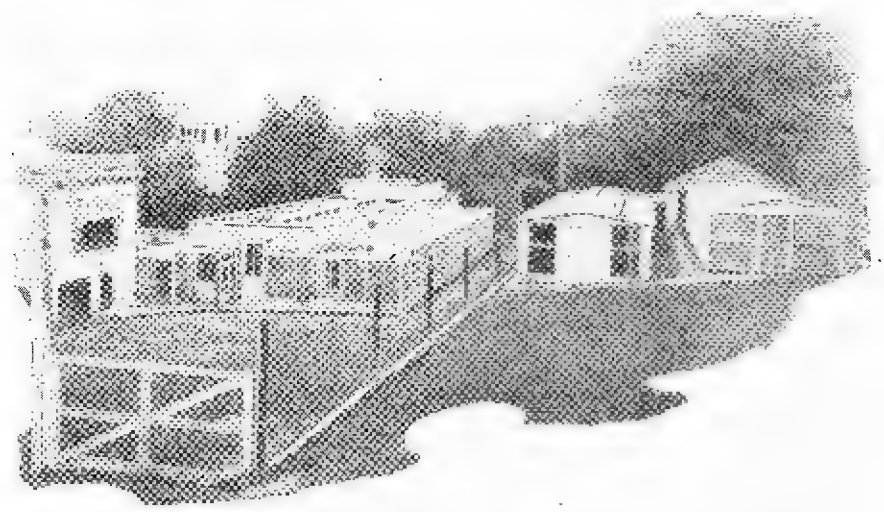
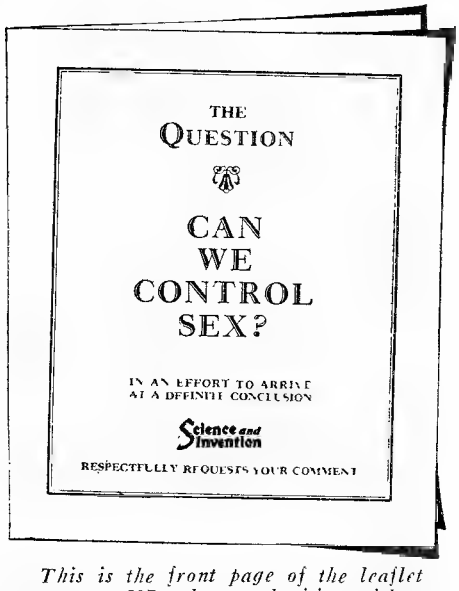
Sex control in some animals is now possible

the disappearing right ovary will then face about and do a remarkable thing. It will again begin to grow. But this time it will develop as a testis, not as an ovary (See Fig. 4). When this formerly female fowl approaches maturity it will take on the appearance and the sex behavior of a rooster. Internally it will have developed a channel for carrying sperms from the testis to the exterior; and the sperms will be properly formed in a truly and entirely male germ gland. The female bird has become a male. It was transformed from a female to a male. By this method sex in birds has been and is being controlled by a number of scientists. Other successful methods of controlling sex in a few other animals and plants could be cited.

There is at present much reason for maintaining that we are now getting an understanding of the innermost nature of the several methods that have been employed in controlling the sex of various animals. Some of us associate all of the changes which have been proved to accompany changes in a female-to-male direction with an increase, or speeding up, of the oxidations of the developing embryo. Conversely, all of the methods which change males into females seem associated with reductions in the speed of oxidations in these embryos. This is the "metabolic theory" of sex. Though this theory is by no means as firmly settled in biology as is the normal chromosomal arrangements for determining sex it has a very substantial variety of facts to support it. On this view the chromosomal differences which normally decide the sex, do so by establishing differences, in metabolic rate; if, however, we artificially establish a type of metabolic rate, we can thus obtain the corresponding type of sex.



Within these buildings, provided with glass sides, and roofs partly of glass, are housed the 1,000 pigeons and doves of the colony maintained by the Carnegie Station for Experimental Evolution, at Cold Spring Harbor, L. I., N. Y. Here Dr. Riddle has controlled, or reversed, the sex of pigeons.



This is the front page of the leaflet sent to 587 select authorities with a view toward arriving at a conclusion on this all-important topic of sex control.

Metabolic Rate Causes Change

VERY diverse and special methods have been used in controlling sex in several animals, though at present these methods are largely or wholly inapplicable to the human and other mammals; but if the ultimate effects of these several methods are reducible to changes in what is known as metabolic rate, we can later hope to employ in man and mammals other and new agencies which can act directly and specifically on metabolic rate in the egg and embryo. The facts already gained will first be of use in correcting sexual deformities and deficiencies in human beings. Almost the sole hope of adequately understanding and efficiently treating some of these cases rests upon the things learned during recent years in the control of sex in other animal forms.

Sex has been and is being controlled in a number of animals. These cases prove that sex is theoretically transformable in all animals. The theoretical barriers have been overcome. Practical difficulties in the case of the human and many other forms now bar the way to the control of sex there. But the difficulties are practical, not theoretical. It is therefore within the province of science to overcome them in the future.

The Questionnaire

SCIENCE AND INVENTION prepared a questionnaire, which as previously stated, was sent to a select list of authorities throughout the country. The results will be published in forthcoming issues of this publication. It is yet too early to make any definite assertion as to the consensus of opinion on this topic, but for the benefit of those who may be interested in this all-important discussion, and to those authorities who we may have missed in originally distributing the pamphlet, and which oversight we regret, the questionnaire follows:

Preliminary

Q. 1. Do you hold the progamous, syngamous or epigamous theory of sex determination?

Q. 2. If you adhere to the progamous theory (wherein the sex of the future individual is determined *before* the fertilization of the egg from which it is to develop, takes place, do you believe that (A) the differentiation takes place in the spermatazoön; (B) or that it takes place in the ovum?

Q. 3. If you uphold the syngamous theory (in which the sex determination takes place at the same time of union between the spermatazoön and the unfertilized egg, do you consider the quality or the number of chromosomes influence the sex?

Q. 4. If you uphold the epigamous theory in which sex determination is due to external factors acting on the embryo, what external factor do you consider the most important?

Specific

There are approximately 500 theories concerning sex predetermination. A few of the most universally held are here questioned. Any information which you can give from your own observation or the observation of those known to you will be appreciated.

Q. 5. In your opinion, is there any way or do you believe any method can be discovered wherein the nature of the sex of the offspring can be selected, if not consistently, at least to the point of bringing the odds in favor of the parents' desire?

Q. 6. The proportion of males to females in European countries is 106.3 to 100 when (*Continued on page 770*)

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Cities *of* Tomorrow

What Two Great Thinkers Forecast

Dr. Lee de Forest, Famous Radio Engineer and Scientist, Says:

DR. LEE DE FOREST, *famous radio engineer, scientist, and inventor of the audion.*

ONE of the foremost American scientists who has left his mark in the Hall of Fame is Dr. Lee de Forest. Dr. de Forest invented the three-electrode vacuum tube or Audion, which is now being used by millions all over the world to energize our wonderful voice and television amplifiers and transmitters as well. Whenever we sit and listen to fine music as transmitted and received by radio, we may thank this great genius for his remarkable scientific deduction made 25 years ago, that three electric conductors or electrodes, sealed into an evacuated glass tube, would accomplish the wonders that are now so common.

Television

THE writer opened the interview with Dr. de Forest by asking several questions concerning the latest brain-child of science —television. Dr. de Forest said that he believed that C. Francis Jenkins and Dr. D. MacFarlane Moore had done more for television, as we know it today, than any other research workers. He named particularly the revolving disc fitted with lenses which was invented and patented by Jenkins and which is now being appropriated by other television workers, as he pointed out, and the very wonderful new neon crater lamp perfected by Dr. Moore. The Moore crater lamp has made it possible to enlarge the received television image up to a size 12 x 12 inches. It has several hundred times the illumination of the ordinary neon lamp sold to television experimenters.

I asked Dr. de Forest whether he thought the cathode ray tube, in which a beam of electrons is moved about or caused to scan a target by means of magnetic or electrostatic fields, would ever prove successful for television receivers; especially to help eliminate the present revolving perforated disc devised by Nipkow. Dr. de Forest stated that he thought there was a possibility of perfecting the cathode ray tube but that at present one of the difficulties with it was that the target or spot where the beam impinged on the fluorescent screen was not sharp. He suggested that further research might be carried on along the line of endeavoring to concentrate and sharply focus the cathode ray itself by means of a properly designed magnet.

Dr. de Forest waxed enthusiastic over the new inventions of Mr. C. Francis Jenkins, particularly the use of a flat grid of light sensitive cells used to pick up the image in the television transmitter. In this grid, which comprises about 2,300 small light-sensitive cells, the successive cells are connected by means of a special commutator, (*Continued on page* 750)

Harvey Wiley Corbett, Prominent American Architect, Predicts:

ONE of the most famous architects in America, a man who has designed and supervised the building of some of the largest and tallest skyscrapers so far built, was recently asked by one of the editors what he thought the city of tomorrow would look like. The accompanying illustrations, one of which bears Mr. Corbett's signature, will give the reader quite a comprehensive idea of the probable appearance of our larger cities of the future.

An architect has to continually plan new buildings which will be adapted to the requirements of various civic and commercial bodies, ten to twenty years ahead, and so Mr. Corbett is particularly well prepared to give us a glimpse into the future, and tell us how we are going to live, particularly in the large cities like New York, Chicago, and Philadelphia.

HARVEY WILEY CORBETT, *leading American architect and skyscraper designer.*

Mr. Corbett pictures the city of the future, that is, fifty to one hundred years from the present time, as being laid out in checkerboard fashion; the combination residential and office buildings, such as those shown in the illustration on the opposite page, occupying alternate squares or blocks in the city plan, while the other interlocking blocks will contain parks. These parks are not suggested so much from the esthetic point of view as they are from the reason that they will allow the sun to bathe any individual building on the east, south and west sides. The tall towers contain airplane landing platforms; each platform assigned to a different route, will be placed at the north end of each building, according to Mr. Corbett's plans, many of which he has drawn up in quite elaborate form, and many of the advanced ideas incorporated in these future building schemes worked out by this architectural genius, will be shown in actual physical form at the Chicago World's Fair, to be held in 1933. Mr. Corbett has been chosen as Chairman of the Architectural Design Committee, and probably no one in America is better qualified for this position.

THE city of tomorrow—fifty to one hundred years from the present—will, without a doubt, be considerably different in many ways than the cities we know today. Two of America's leaders, Dr. Lee de Forest, well-known radio and electrical scientist, and Harvey Wiley Corbett, prominent architect and designer of skyscrapers, give herewith their predictions of what we may expect to find in the cities of the future. Do you think that aircraft will supersede automobiles and trains fifty to one hundred years hence? Do you think that television will be broadcast by radio or by wire in the future? Shall we live in the upper floors of the large business structures in the future city, or will everyone live in the suburbs? These and many other interesting questions are answered in the two opinions presented exclusively in the interviews herewith.

The large city buildings here proposed will comprise three distinct sections, the first fifteen floors being devoted to stores, offices, etc., the second fifteen stories to residence requirements, and the upper part of the tower to airplane landing platforms. Most of the building elevators will be grouped in the tower, and one will be able to ascend to any airplane station platform desired, or he may descend to the moving platform subways just below the street level, or still lower to the high-speed express subways, shown in one of the accompanying pictures.

In regard to the construction of (*Continued on page* 773)

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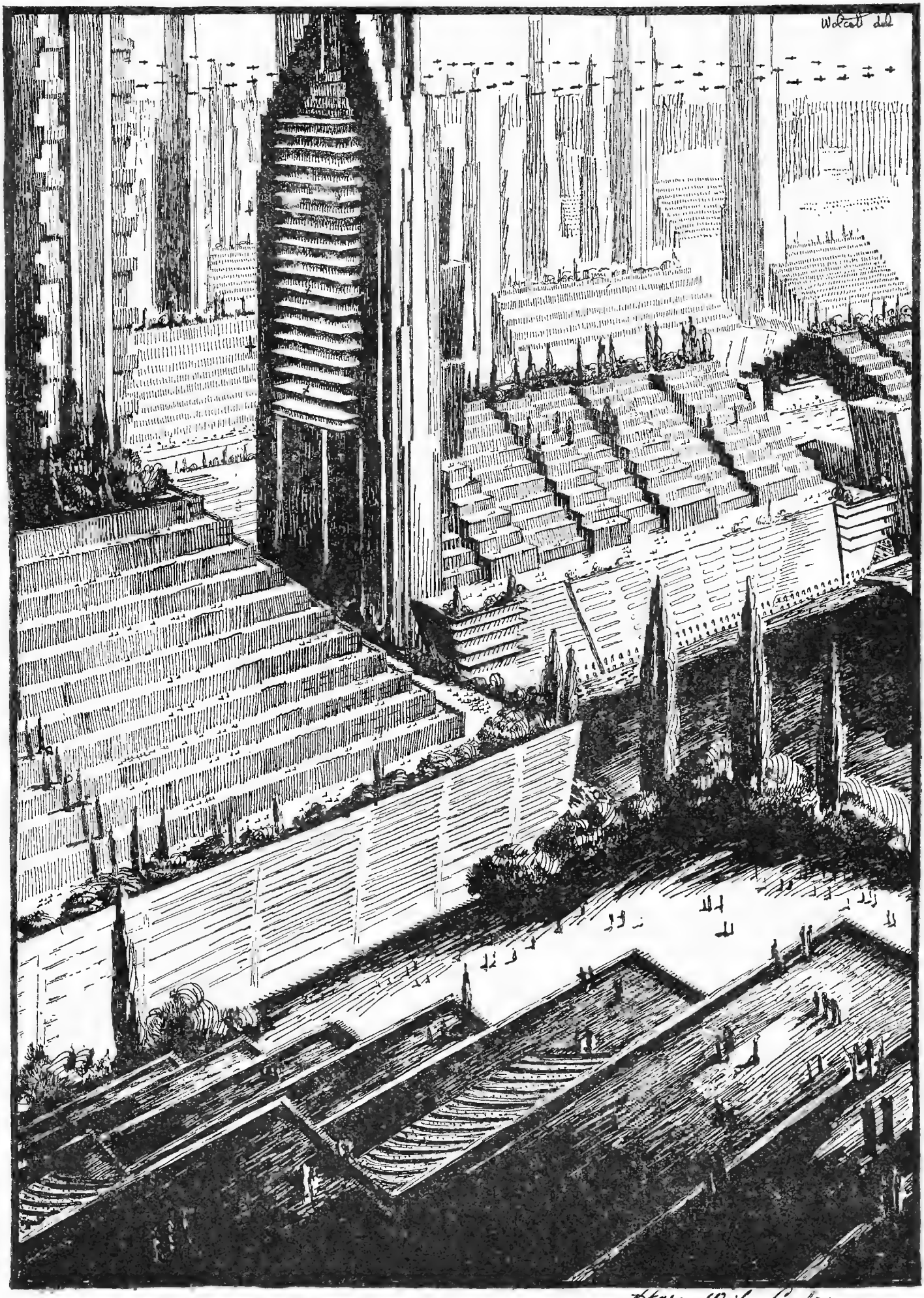

A glimpse of the city of the future, as envisioned by the well-known American architect, Harvey Wiley Corbett. Each building combines business and residential floors.
(See next page for sectional view)

Courtesy Arnold Constable, N. Y. C.

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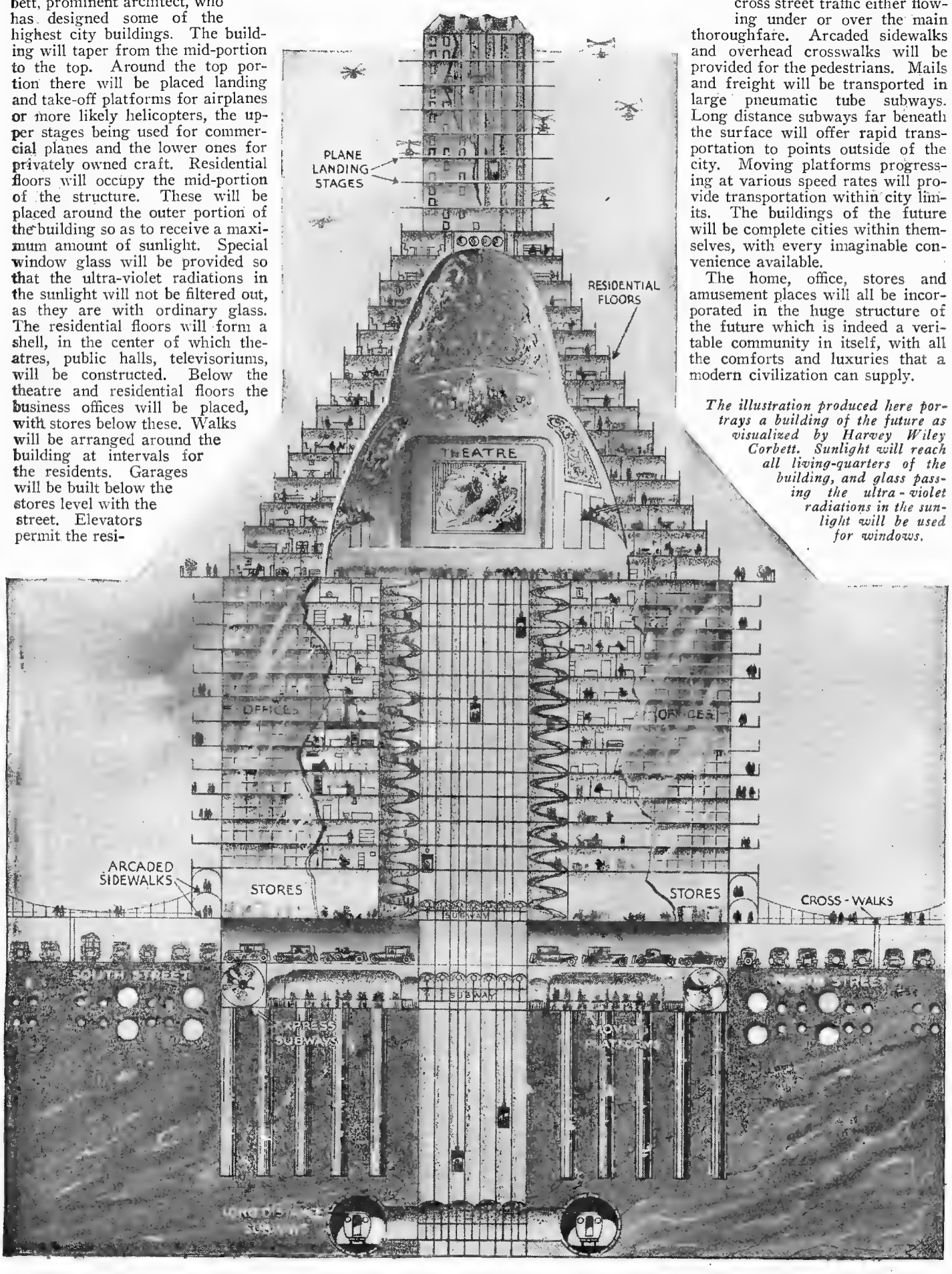
Cities of Tomorrow

(*Continued from previous page*)

OUR future cities will consist of a group of large buildings such as that illustrated here, according to Mr. H. W. Corbett, prominent architect, who has designed some of the highest city buildings. The building will taper from the mid-portion to the top. Around the top portion there will be placed landing and take-off platforms for airplanes or more likely helicopters, the upper stages being used for commercial planes and the lower ones for privately owned craft. Residential floors will occupy the mid-portion of the structure. These will be placed around the outer portion of the building so as to receive a maximum amount of sunlight. Special window glass will be provided so that the ultra-violet radiations in the sunlight will not be filtered out, as they are with ordinary glass. The residential floors will form a shell, in the center of which theatres, public halls, televisoriums, will be constructed. Below the theatre and residential floors the business offices will be placed, with stores below these. Walks will be arranged around the building at intervals for the residents. Garages will be built below the stores level with the street. Elevators permit the residents to descend from their homes to their office, to the stores, to the street or subway. Traffic will move only one way on a street, with cross street traffic either flowing under or over the main thoroughfare. Arcaded sidewalks and overhead crosswalks will be provided for the pedestrians. Mails and freight will be transported in large pneumatic tube subways. Long distance subways far beneath the surface will offer rapid transportation to points outside of the city. Moving platforms progressing at various speed rates will provide transportation within city limits. The buildings of the future will be complete cities within themselves, with every imaginable convenience available.

The home, office, stores and amusement places will all be incorporated in the huge structure of the future which is indeed a veritable community in itself, with all the comforts and luxuries that a modern civilization can supply.



The illustration produced here portrays a building of the future as visualized by Harvey Wiley Corbett. Sunlight will reach all living-quarters of the building, and glass passing the ultra-violet radiations in the sunlight will be used for windows.

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The Luminous Human Fountain

This Scientific and Sensational Experiment Produces Phenomenal and Excellent Effects

A Magic Trick That Amuses European Audiences

Effect

WHEN the curtain is raised, the spectators see in the middle of the scene quite a large silvered vase about twenty-eight inches in diameter, carried on three legs also silvered.

This vase, marked A in the picture, contains a cylindrical recipient B.

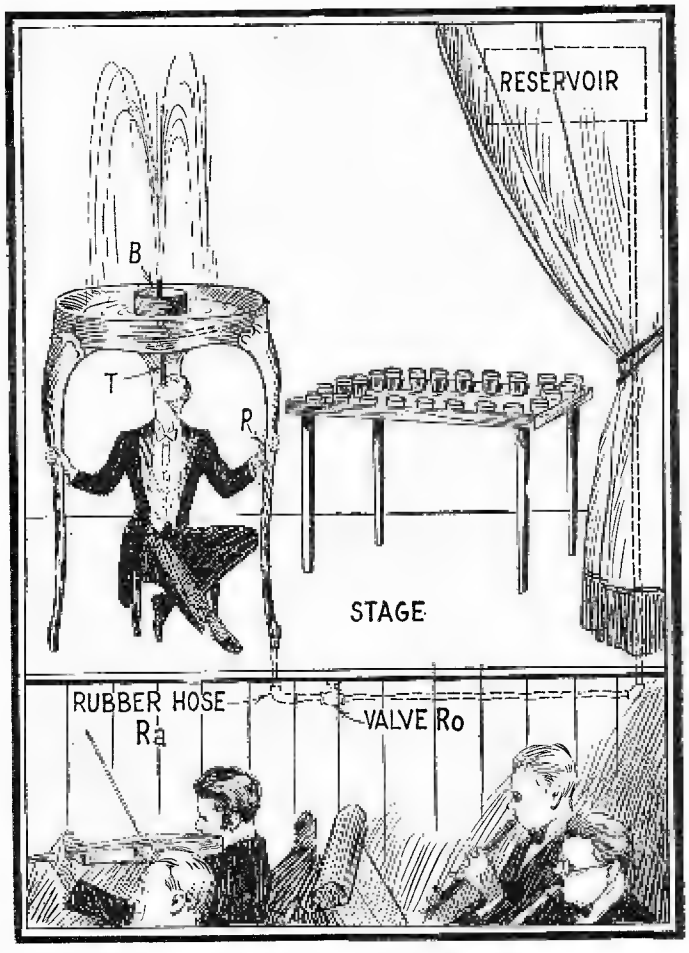
In its center a small India rubber tube T passes down through its center. A little bench is placed between the three feet.

This very simple arrangement is completed by a table which is placed on one side of the stage and carries a dozen tumblers full of water, that is to say, pure water, slightly colored so that its presence can be recognized. Around the table there is a rather high ledge to stop the glasses from sliding off and falling on the floor.

The magician then enters, bows to the public and commences his explanation: 'The human stomach is something extraordinary and it lends itself to all the fantasies which one wishes to impose upon it. I will recall to you the curious experiment which consists in introducing into the stomach bayonets or sword blades, and also that one in which the performer introduces into the stomach the great glass of water containing some little frogs, and gives back in an instant the frogs and liquid. I hope to show you something more curious than all that. You see on this table fifty tumblers full of water slightly tinted with a few drops of wine, so that you can be sure of what is in them at a distance. To one side you see a simple vessel mouned on three thin legs, and at the middle of the vessel there is a cylinder containing an electric light which will impart color to a miniature fountain. The principle of this apparatus involves an electric lamp and a series of tumblers of various colors to be placed between the lamp and the little fountain.

"It's a little mechanical curiosity about which I will say nothing more, but I want you to notice especially the new process which I employ for producing the jet of water, which is to be colored. I will swallow, one by one, and quickly, the contents of these tumblers, and this will fill up and swell up the stomach to an inordinate degree. Then I sit down on the footstool under the vase; I'll next take the end of the rubber tube in my mouth which you see hanging down in the middle. I then blow into this tube in a special manner, and all the liquid absorbed will be rejected, so as to supply the luminous fountain with a good-sized jet for several minutes."

What he seems to do is to go behind the table at the side of the stage; swallow rapidly the contents of the tumblers which are in front of him and then, seating himself below the vase, he blows into the tube and the fountain plays and is lighted up. The effect lasts for quite a while, so that the question arises—how can a man's stomach hold so much water?



The above illustration gives the details of the human fountain trick. T is the rubber tube, B is the cylindrical bowl, and P is the spring cock.

Explanation

THIS is how it is done: When the performer goes behind the table to swallow the water from the tumblers, he does it all with a disconcerting rapidity, taking a glass first with one hand, and the next with the other, and putting them back very rapidly after he has imbibed (?) their contents. But he works so fast that he doesn't drink all the contents of each tumbler; far from it.

He puts back one glass and picks up the next one with the other hand, so that no one can really tell if he has drunk anything. The ledge of the table supposed to prevent the tumblers from falling off, effectually hides the water, which he has not really drunk and which remains in the tumblers.

When he takes his place under the vase, and takes the India rubber tube in his mouth, to produce the required jet of water, he doesn't project anything, but he touches a spring cock or valve P, when he apparently is holding the two legs of the structure with his hands, as shown. The leg on the right is hollow, and it really contains a tube which conducts the water from a tank hidden in the scenery at a height to project the water about ten inches in the air. When the vase on its stand is brought upon the stage, the leg, which has a joint, Ra, is pushed into an opening at the end of the elbow of the tube. When the fountain is to operate, an assistant opens the valve Ro concealed under the stage, and the water from the tank rises to the spring cock P, so that the water will pass out at the least pressure, says Alber in *La Nature*.

This experiment, without being absolutely sensational, produces an excellent effect.

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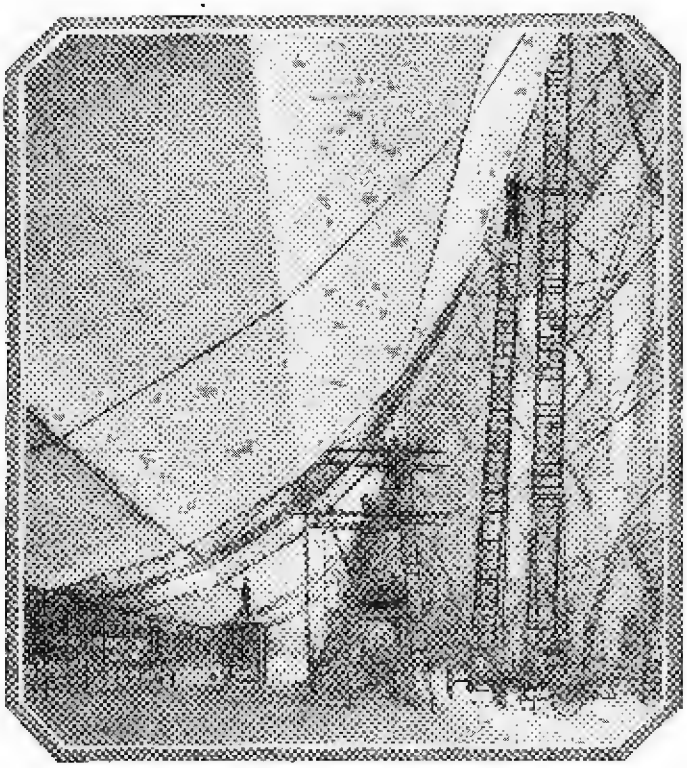
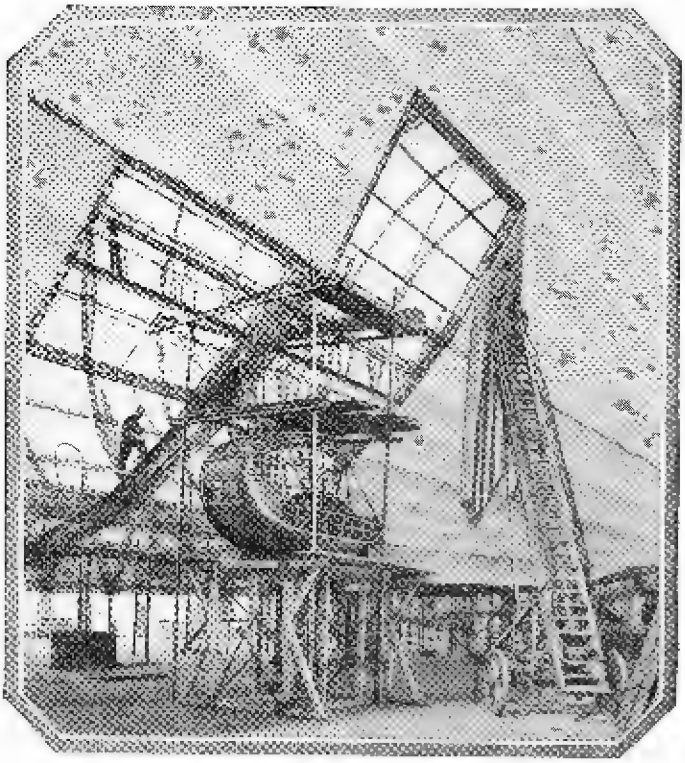
THE GRAF ZEPPELIN ARRIVES

By DR. A. GRADENWITZ



The above illustration gives a view of the dirigible in the factory at Friedrichshafen while it was undergoing construction.



Workmen are covering the frame in the above photograph. The entire frame and all metal work is of duralumin.

Principal Data of the "L. Z. 127"—Graf Zeppelin

Dirigible now capable of carrying a colossal load of 16½ tons with a single trip range of 6,200 miles

A DIRIGIBLE balloon is shaped to give the least air resistance. In its present state of development the airship may be divided into three classes; non-rigid, semi-rigid and rigid. The latest German Zeppelin is of the latter type. This has its gas compartments surrounded by a strong structure which is capable of withstanding great pressures and prevents the loss of gas. Furthermore, at high speeds, the ship retains its form. The gas is contained in a number of compartments so that if one is punctured the dirigible will not fall. This is also of value when maneuvering, as the amount of gas in each section can be regulated separately.

Although the dirigible was developed early in France, most of the later work on the rigid airship was done in Germany. After many failures, Count Zeppelin produced the first successful rigid ship. Previous to the war, airship passenger service was running in Germany successfully. It was not, however, until after the battle of Jutland that the building of rigid types began in this country. The advantages of the rigid type were first realized in this battle.

The latest Zeppelin, the 127th of a long line of predecessors, known as the Graf Zeppelin, made a very successful trip across the European continent. The Graf Zeppelin, the last word in dirigibles, was built at Friedrichshafen, Germany. The ship is powered by five reversible Maybach engines, each one developing 530-horsepower and giving a maximum speed of 80 miles per hour. With a volume of 3,700,000 cubic feet, and a total diameter of 100 feet, the craft measures 775 feet long. The useful load measures 33,000 pounds, depending on the freight carried and the actual commercial speed, with a total distance of 6,200 miles to be covered at a speed of 62 miles per hour. A crew of twenty-six men will be carried, and ten cabins each with two berths are provided, in addition to a sitting and a dining room, and an up-to-date kitchen. This represents the largest Zeppelin ever built, and it is made of duralumin, which is light in weight and yet will give a twenty per cent increase in mechanical strength. After undergoing trial trips, the "L. Z. 127" is temporarily to be chartered by a Spanish company, and will be used in connection with an airship service operating between Spain and Argentine.

A modern rigid airship has a hull (*Continued on page* 751)

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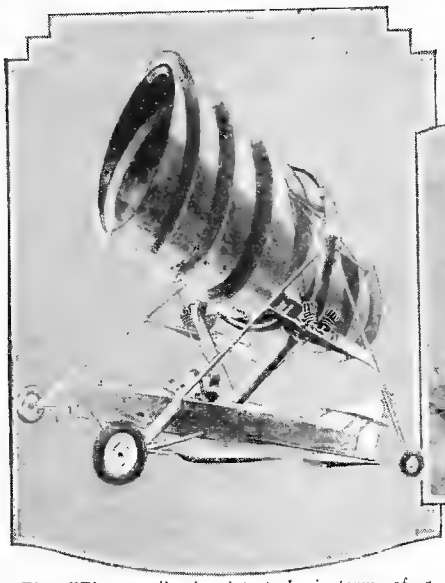
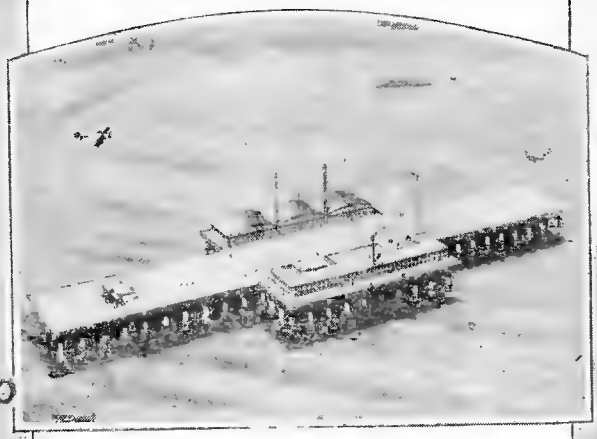


The "Flyworm," the latest brainstorm of a California inventor, has no wings nor propellor and will also run in water and on land.



The above illustration shows how airplanes in the future will utilize a floating landing and take-off station as an intermediate stop in trans-oceanic flights. Here the planes will refuel, make repairs if necessary and perhaps transfer passengers. Neon beacons will mark the landing in foggy weather and at night.

Above is shown a small 100 ft. dirigible landing upon the roof of a store in Cleveland.

Aviation's Advance

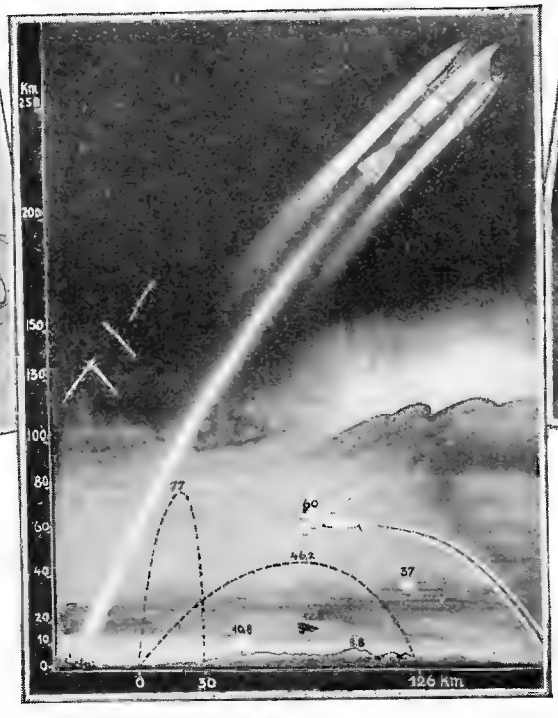
Latest Air News in Pictures

The photograph at the left shows the Roma making a trial flight. The wheels fold up under the wings when the plane is flying. A trip to the continent is soon to be undertaken with this newest craft.

At the right is a photograph of a new motor for airplanes that weighs only one-sixth as much as the present type. It is a semi-turbine rotary engine with two housings. It weighs only 220 lbs. and is claimed that under tests the motor developed 450 horsepower. Combustion takes place in the rear housing.

An Austrian aeronaut and astronomer has designed a new type of rocket plane capable of making a trans-oceanic flight in a short time. The illustration below compares the relative heights obtainable by balloon, airplane, projectiles, and the newest rocket plane. From the illustration it is evident that the plane consists of three sigar-shaped tubes, with rockets placed in the rear of each of the outer sections.

Prof. Zaschka, a German inventor, is shown above with a working model of his helicopter. This is expected to rise vertically from the ground and requires very little space for a take-off. This idea, of course, is not at all new and has been tried a number of times without much success. Helicopters were built which rose a short distance but were not capable of sustained flight. The inventor of this machine, however, is confident of success and is preparing to demonstrate at the Berlin flying field.



Above is Theodore S. Lundgren, of Los Angeles, with his invention, a drift indicator, which was used on the Southern Cross. The instrument consists of a semi-circular metal plate mounted horizontally on the fusilage. The navigator is enabled to tell just how many degrees he is off his course by looking at the graduated scale. A vertical wire casts a shadow on the scale indicating the variation from the course.

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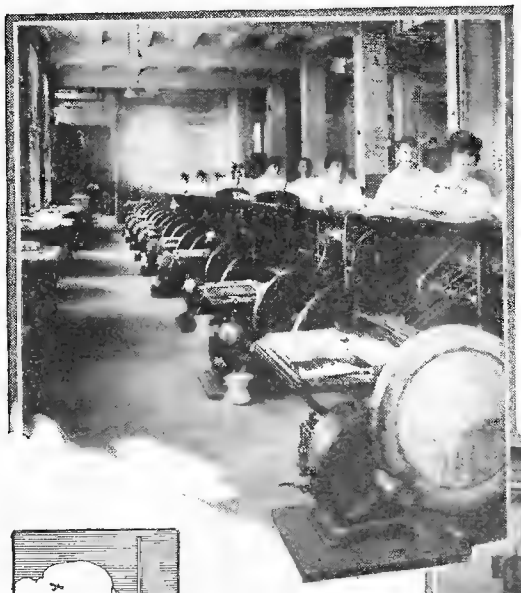
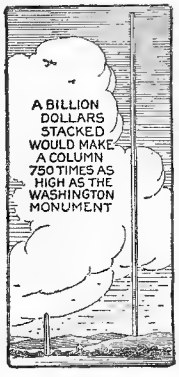
Money

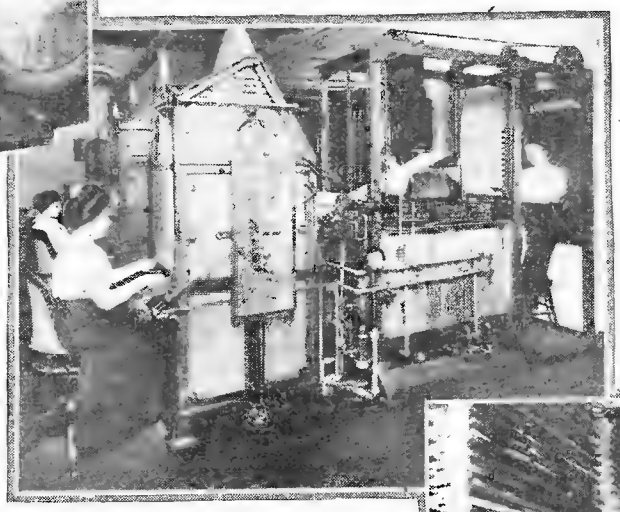
While Billions of Dollars Are Being Manu-

By
AL. BERT. COLE



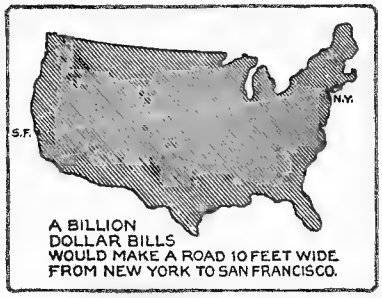


Hand presses are more economical for shorter runs and the plates can be changed quickly and easily.



If paper money is not allowed to dry out sufficiently it wears out in a much shorter length of time than it should. This photo shows one of the stages of the drying out process at the U. S. Bureau of Engraving and Printing.

THE LIFE OF A DOLLAR



If paper money is made smaller it will permit of faster handling in the driers and curing process. The curing process is shown above. Insufficient curing means "green" bills which wear out quicker.

Money, money — everywhere we see stacks of bills — millions of them — ready to be delivered when needed to the banks of the United States. This is a section of the storehouse where money is kept for purposes of distribution.

When Frank White writes his name he does so boldly. The reason is that Mr. White is treasurer of the United States and his signature is needed on the currency. This is reduced for proper placement.

NOW that we are going to have some new currency, it may be well to take stock of Uncle Sam's pocketbook and find out by just what method of presti-digitation he brings it forth, that we may spend our lives vainly seeking to acquire its numerals.

The pocketbook of Uncle Sam is always well filled. If an industrious citizen started to count money as soon as he was old enough to figure, it would take him over one hundred years to count but a billion dollars, dollar by dollar, and he would have to work eight hours a day. If this amount of greenbacks were placed end to end, they would form a chain one million miles long. They could be used to make a money road ten feet wide that would reach from New York to San

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Making

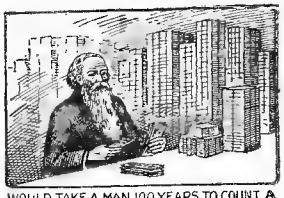
factured Billions of Dollars Are Being Destroyed

12,000 tons of paper money is equivalent to over four Billion dollars of U. S. currency.

Here is a place where money means nothing but work. The girls in this photograph are running the sheets of bills through the trimming machines, previous to their being cut apart.

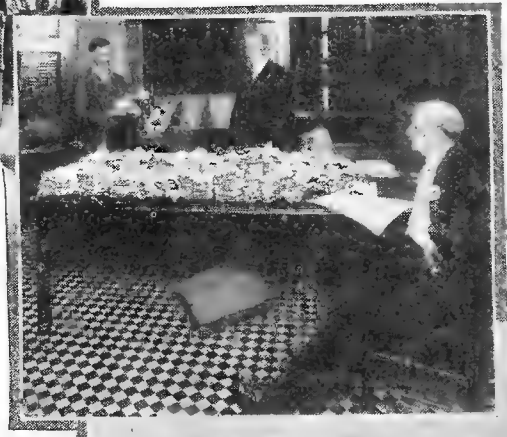
Such wanton destruction! Here bundles of bills are being thrown into the hopper of a macerator. This reduces thousands of dollars worth of worn-out bills into pulp.

Here is the great vault which protects the bank notes from burglars.

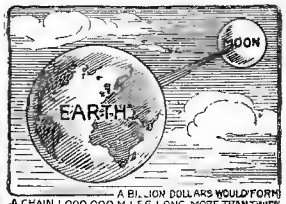


WOULD TAKE A MAN 100 YEARS TO COUNT A BILLION DOLLARS WORKING 8 HOURS A DAY

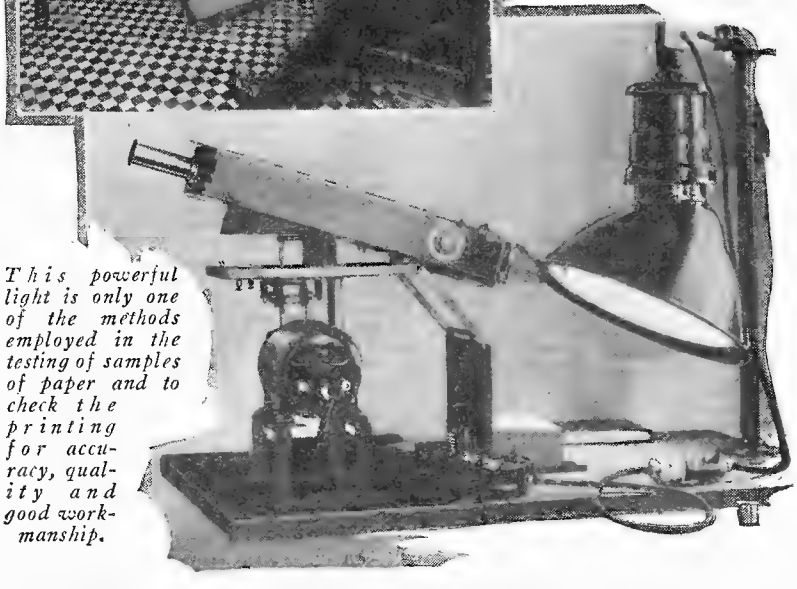
HOW DOLLAR BILL IS SPENT



Right: A careful check is constantly being made of the worn and torn bills received from the banks daily. After each one is properly accounted for the bills are sent to the macerator which again reduces them to pulp. Hundreds of thousands of dollars will be saved when the size of bills is reduced.



A BILLION DOLLARS WOULD FORM A CHAIN 1,000,000 MILES LONG, MORE THAN TWICE THE DISTANCE FROM THE EARTH TO THE MOON & BACK



This powerful light is only one of the methods employed in the testing of samples of paper and to check the printing for accuracy, quality and good workmanship.

Francisco; and if stacked together in a gigantic pile, they would reach an elevation 750 times as high as the Washington Monument.

But this amount is only two-fifths of the reserve bank notes that are stored in the government vaults at Washington. At present more than three million bank notes of all amounts are made daily at the U. S. Treasury's Bureau of Engraving and Printing.

Again, these figures are important because not only do we require such a tremendous amount of money for modern business, but the annual mortality of this paper money aggregates 1,200 tons yearly. A slight conception of the number of bills needed to make this amount will be found by placing a greenback on the postal scales. The crisp new or the old bill is like the small dust on the balance, registering not at all.

Crippled, decrepit, maimed, partially mutilated, grooved and worn, an endless flood of currency comes back to the National Treasury. They are fit only for maceration and extinction in the Redemption Division of the Treasury.

To manufacture 1,200 tons (*Continued on page* 763)

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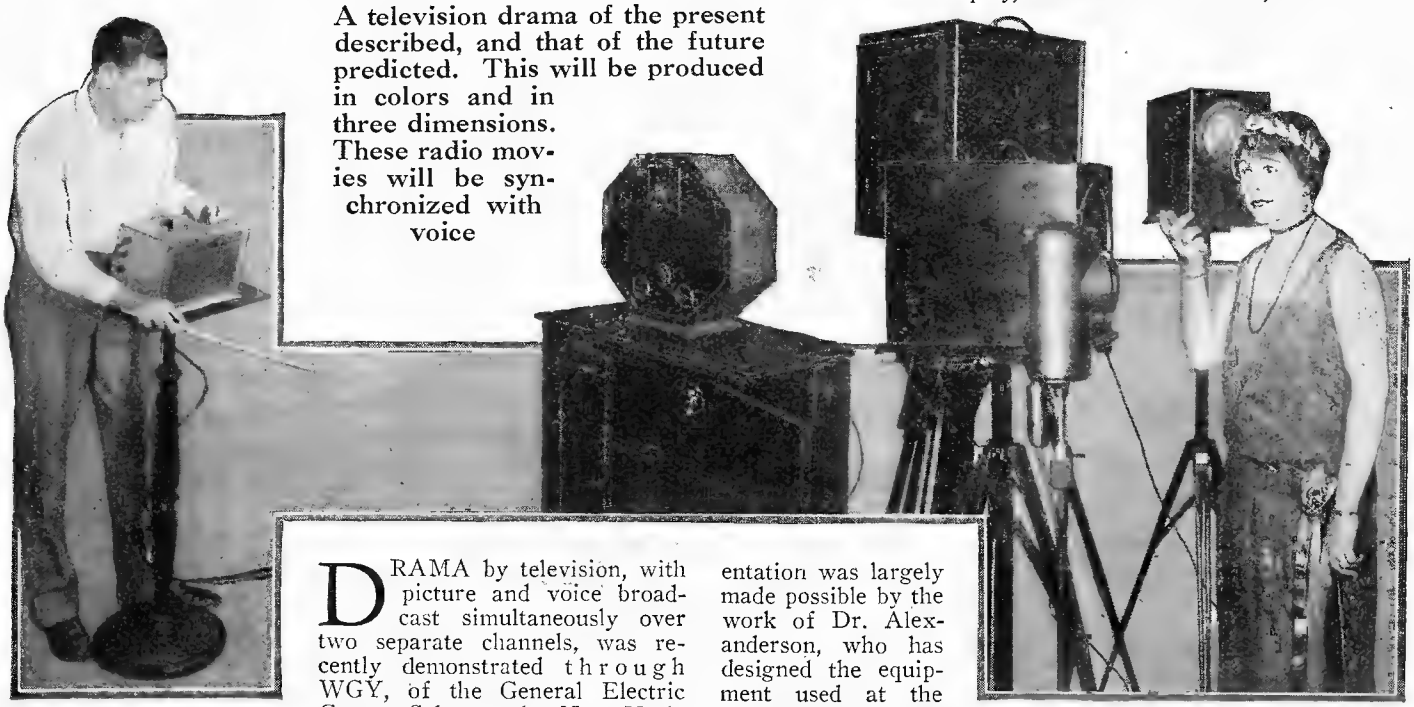
Drama *via* TELEVISION

Plays Both Seen and Heard

The photograph below shows Izotta Jewel, former star, who was the leading woman of the play, and Mortimer Stewart, director.

A television drama of the present described, and that of the future predicted. This will be produced in colors and in three dimensions. These radio movies will be synchronized with voice

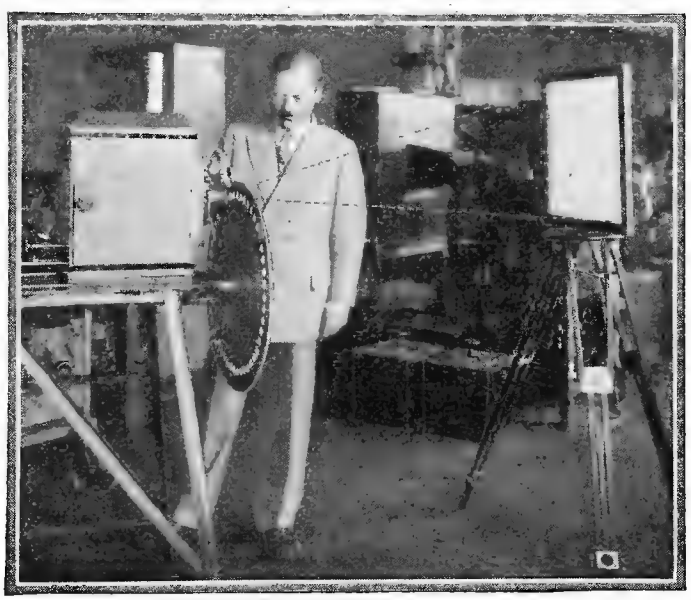


DRAMA by television, with picture and voice broadcast simultaneously over two separate channels, was recently demonstrated through WGY, of the General Electric Co., at Schenectady, New York. Those who had suitable receivers heard and saw the play, "The Queen's Messenger." This presentation was largely made possible by the work of Dr. Alexanderson, who has designed the equipment used at the present time. The one-act drama was presented on the afternoon of September 11th, and the television version was the same as the stage offering, but many new problems in dramatic technique had to be surmounted.

The transmitter was of the portable type and could be carried easily from place to place. The television camera as used at the present time consists of three units, a cabinet containing a 1000-watt lamp, a 24 in. disc, and two smaller cabinets each containing a photo-electric cell and (*Continued on page* 762)

The photograph above shows two of the characters and the "props" used in staging the drama. Three portable television cameras were used, one for each of the characters, and the third for the "props" and hands. Action was introduced by showing the hands of a man and woman using revolvers, cigarettes, and numerous other things. Because of the limitations in the art only the faces of the actors can be shown.

The photograph below shows Dr. Alexanderson, of the General Electric Co., who has designed and developed the system now used at station WGY. The new projection apparatus is shown in the photo.



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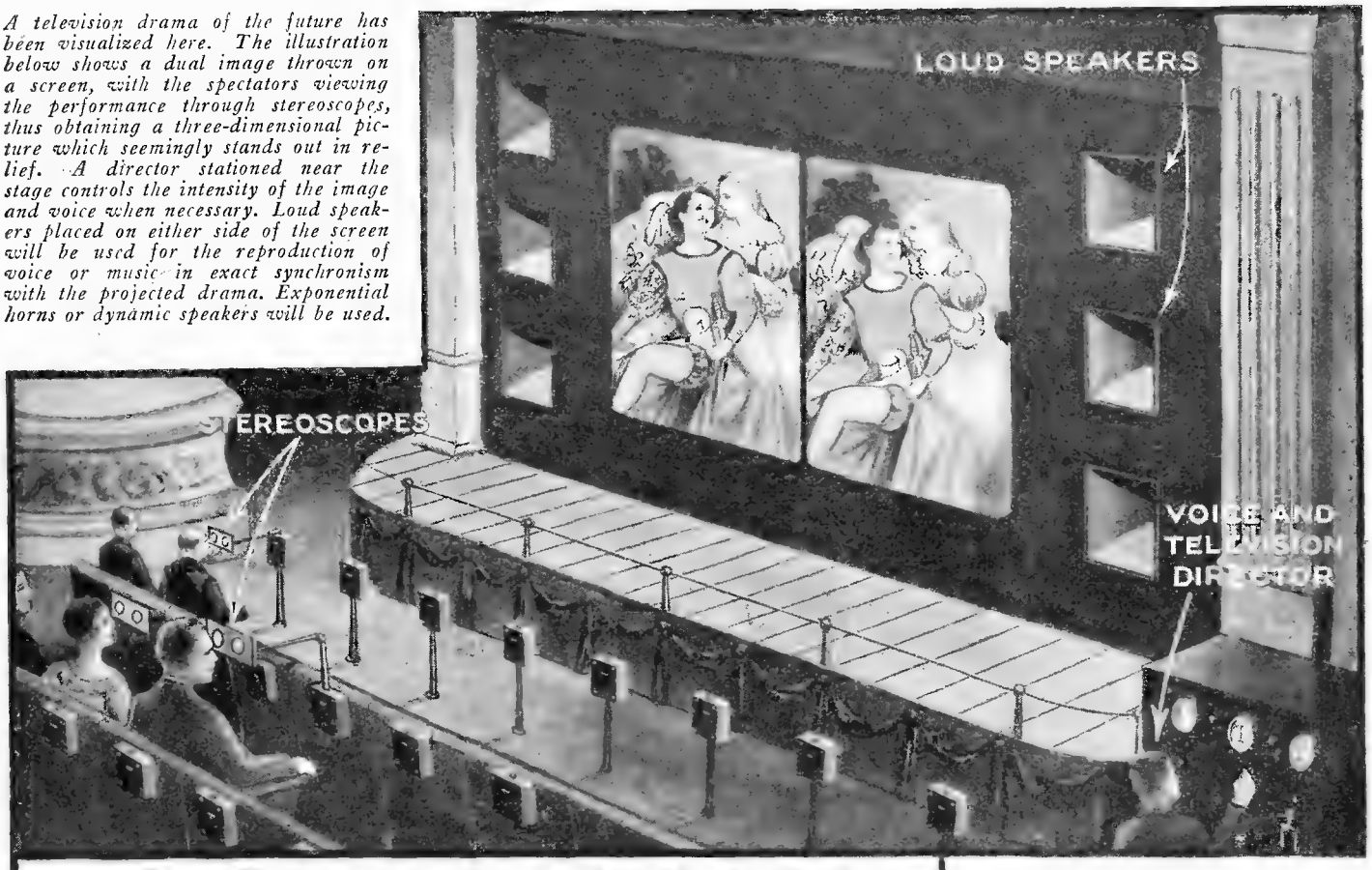
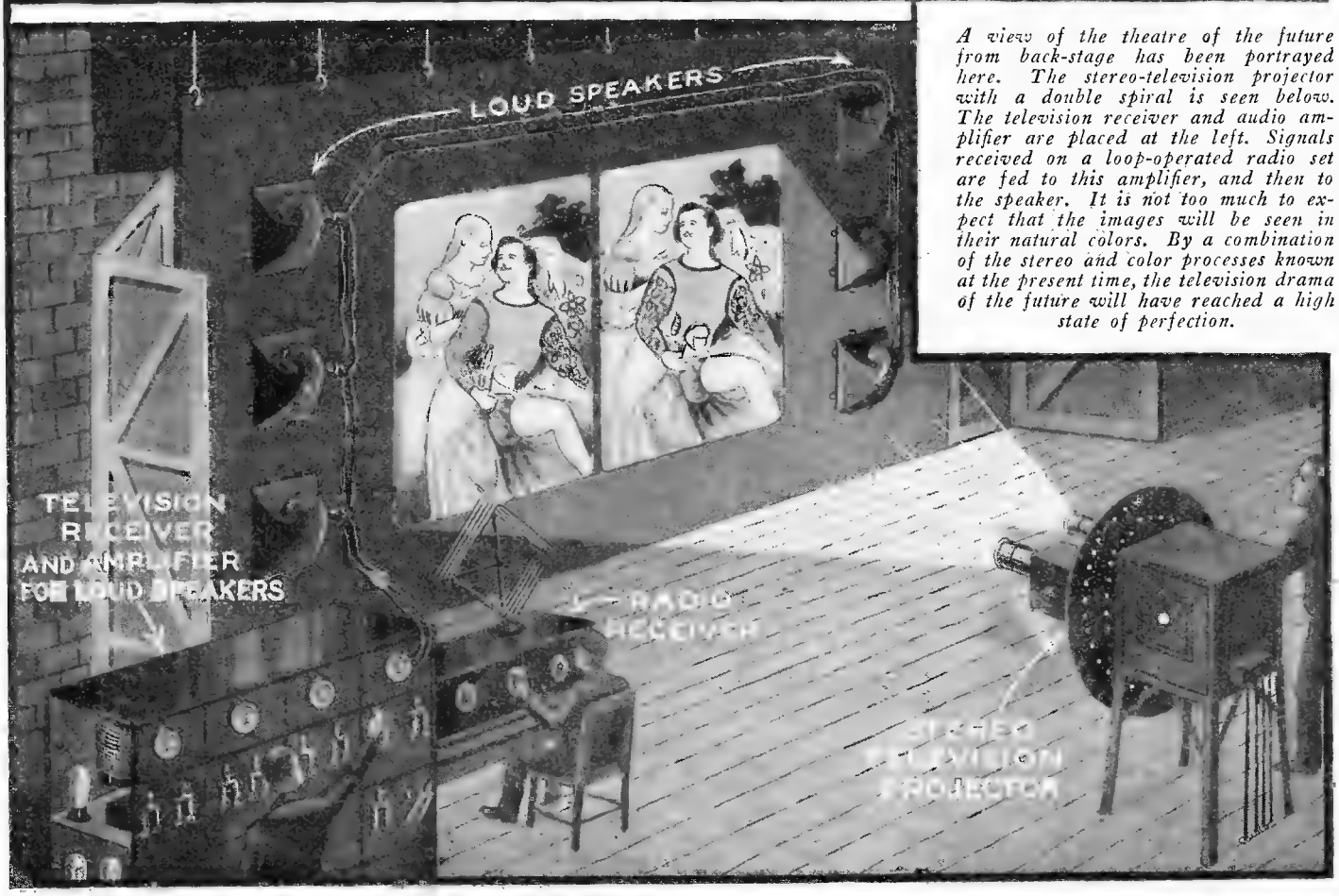
TELEVISION Drama OF TOMORROW

A television drama of the future has been visualized here. The illustration below shows a dual image thrown on a screen, with the spectators viewing the performance through stereoscopes, thus obtaining a three-dimensional picture which seemingly stands out in relief. A director stationed near the stage controls the intensity of the image and voice when necessary. Loud speakers placed on either side of the screen will be used for the reproduction of voice or music in exact synchronism with the projected drama. Exponential horns or dynamic speakers will be used.



A view of the theatre of the future from back-stage has been portrayed here. The stereo-television projector with a double spiral is seen below. The television receiver and audio amplifier are placed at the left. Signals received on a loop-operated radio set are fed to this amplifier, and then to the speaker. It is not too much to expect that the images will be seen in their natural colors. By a combination of the stereo and color processes known at the present time, the television drama of the future will have reached a high state of perfection.



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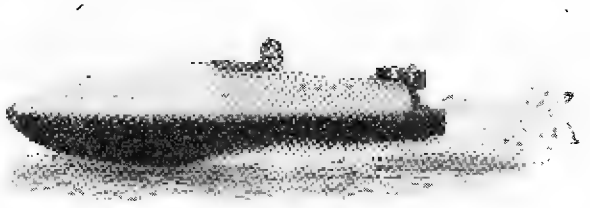
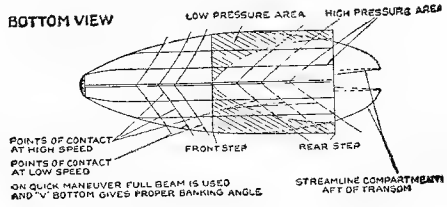
Scientific

A Photographic Picturization of Discoveries and

The above photographs show a new apparatus for resuscitating asphyxiated newborn babies. More than a score of infants have already been brought back to life with this new machine.



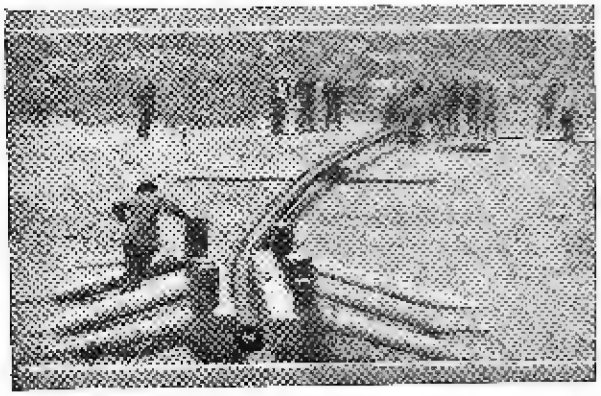

BOTTOM VIEW
LOW PRESSURE AREA
HIGH PRESSURE AREA
POINTS OF CONTACT AT HIGH SPEED
POINTS OF CONTACT AT LOW SPEED
FRONT STEP
REAR STEP
ON QUICK MANEUVER FULL BEAM IS USED AND "V" BOTTOM GIVES PROPER BANKING ANGLE
STREAMLINE COMPARTMENTS AFT OF TRANSOM

Above—A new type of speed boat which recently shattered a number of records. The boat is 12 ft. long, with decks of airplane cloth, and weighs 120 lbs. The bottom view shows the construction of this speed craft. There are six longitudinal steps and two cross steps. This new type of bottom decreases the friction and gives a quicker planing action. An added feature lies in the two stern flotation tanks, which are built as part of the hull. This type of construction, when fitted with an outboard motor for which it is adapted, developed an average speed of 30 miles an hour for the Albany to New York outboard motor race.

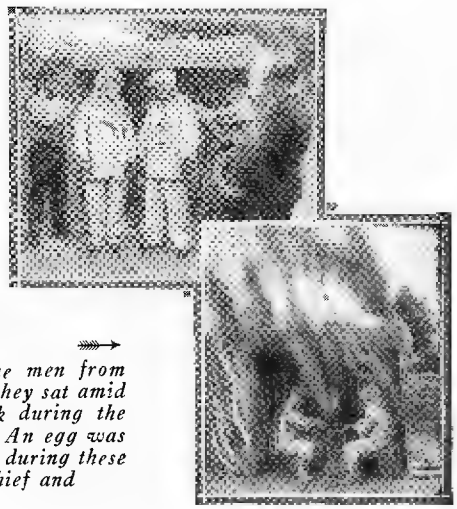
IN our present 20th century civilization it is almost impossible to keep up with the scientific advances made almost daily. With this thought in mind we are showing on these pages a few of the noteworthy and outstanding achievements which have recently been made. These have their respective places in various fields of endeavor of interest to all. Each month we will present the latest scientific achievements and discoveries in picture form.

The photograph above shows the world's smallest phonograph, owned by Miss Gwen Lee. The instrument is built into a watch-case and is operated by a watch spring. The small record speaks about fifteen words of her own voice.

Tests were made recently to determine the strength of fir poles which had been creosote treated under pressure. The butt end of the pole was held between posts and a cable fastened to the other end was acted upon by a locomotive crane. The photo below shows a 60-ft. pole under test.



The photo at the right shows two men clothed in asbestos suits which will be adopted by the Fire Department of Glendale, California.



The asbestos suits saved the men from any injury by fire, although they sat amid the flames of a small shack during the test, as shown at the right. An egg was fried with the heat produced during these tests made by the fire chief and the mayor.

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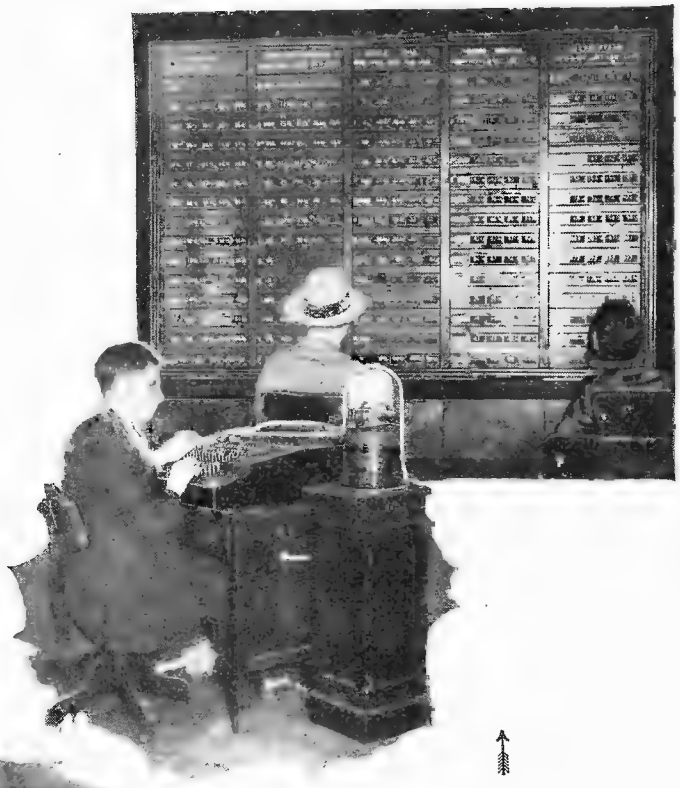
Progress

of Modern Scientific Inventions

Above photo shows "Miss America VII" breaking the world's record with an average speed of 92.8 miles per hour in six laps on a one-mile course on the Detroit River.

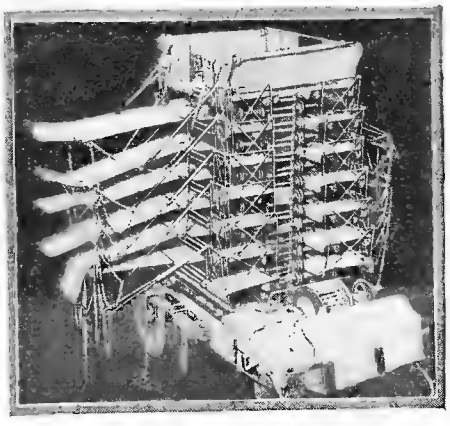


A newly invented stock quotation board eliminates the board box and is operated from a typewriter-like machine. The board shows the high, low and last prices of stocks just as given in the newspaper, and also tells if the market is strong or weak by the flashing of a red or a white light.

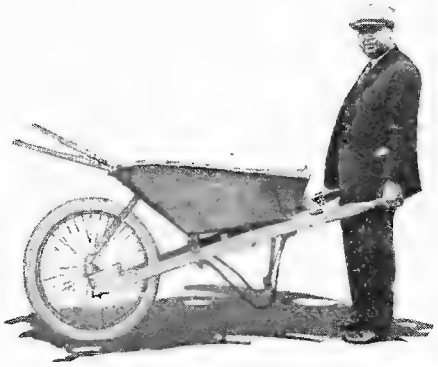
The city administration of Cincinnati, Ohio, will equip all of its policemen with a new stick containing a small camera in the handle. Twenty pictures on a 5/8 in. sq. negative can be taken with one roll of films. The negative made by the camera can be used for enlargements up to 4 in. sq. without distortion. The photo below shows the new police camera.

The above photograph shows a new cob-web-making machine used in the movies. A rubber cement preparation is employed.

Below is a miniature of a new apparatus which enables residents of burning buildings to walk to safety.



The photo at the right shows a rubber-tired wheelbarrow with ball-bearings, which makes the conveyance easy to roll.



The machine shown above is collapsible and can be raised or lowered to any heighth desired. It is now on exhibit in the Berlin Fire Department Museum at Berlin, Germany.

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Why We *Need* Rain

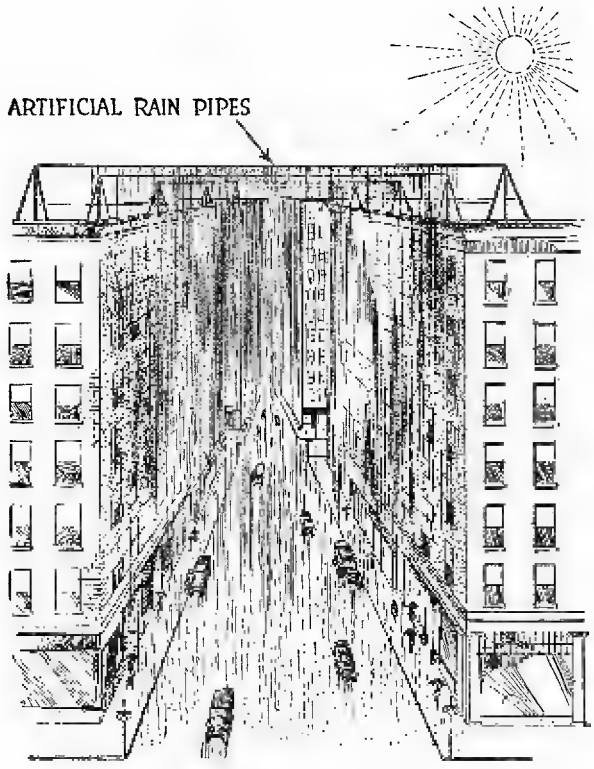
By

PROF. DR. L. HOULLEVIGUE

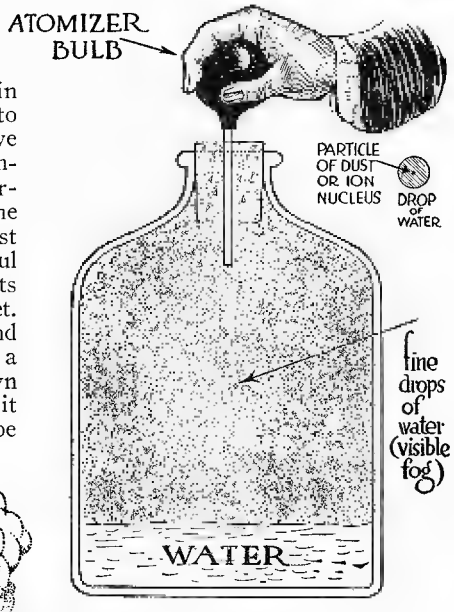
Paris

Rain although disagreeable means health and is the purifier of air

THE tiresome rain! That is what the wisdom of nations says. I will not undertake to vindicate this point of view as long as there are still people who take satisfaction in seeing the raindrops trickling down their window panes, and the poor devils outside walking around in the mud. Science has this in common with religion, that it can turn the daily troubles to a bright harmony with the shadows which must accompany them. Science will show us that the rain we complain of plays a very useful part in the plan of the world, and that we ought not to abuse it absolutely. Like a disagreeable, grumbling servant girl, whose efforts keep the house bright and clean, the rain purifies the air and makes it a good thing to breathe. Therefore, it deserves that we should look at it, I will not say with contentment, but at any rate without any bitterness. How greatly this purification of the air is needed by us, we will realize most thoroughly, if after a series of beautiful days we climb a mountain and, from its summit, look down on the world at its feet. The heaven above us is blue, the air around us is clear and transparent. But what a difference there is, if we cast our eyes down towards the earth, which is spread out, as it were, at our feet. What a mist is to be seen, spreading over the valleys in a sort of sleepy way, sometimes in little patches, sometimes spreading out as the wind sweeps it about. This is all dust, dirt and drops of fog suspended in the atmosphere of our earth.



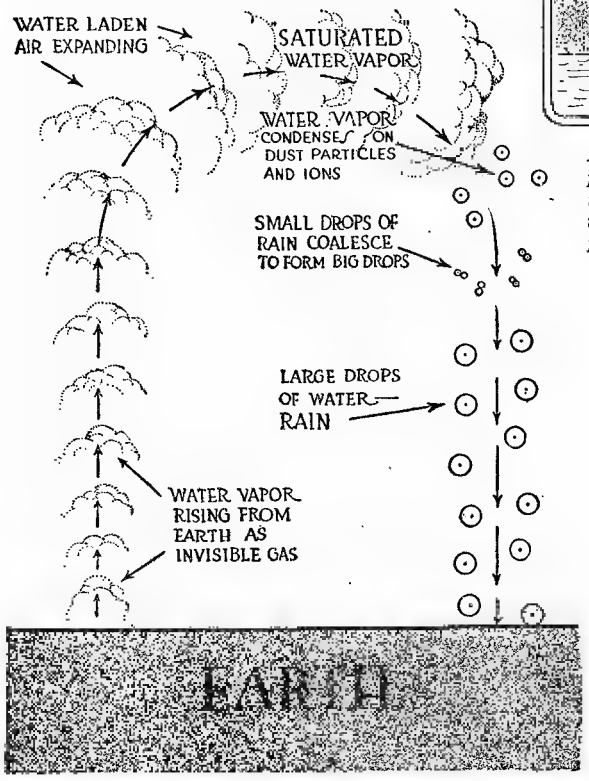
A knowledge of the benefits of rain will probably be responsible for a new method of cleaning the streets in the future. The dust in the air will be washed down by "rain stations" on the roofs of buildings. The water will fall therefrom in fine drops, as illustrated above.



Above is shown a simple experiment which can be carried out to illustrate how rain is formed. Nature reproduces the same experiment on a large scale.

If you want to learn more about this atmospheric dust, we must examine it with a microscope. The first thing we will see are many inorganic specks, such as particles of soot, ash, little crystals, especially those of sea salt, and alum, but above all, numberless sharp silicious scales, which, when they get into the lungs, very easily occasion trouble. After these are numerous organic objects, such as bits of cotton, dried cells, pollen dust, spores and—dreadful to say—bacilli and bacteria, whose fright inspiring names I will not attempt to give. But to quiet our anxious spirits, we must carefully note the fact that the dead elements are always in the majority; some investigators, by extended investigations among a hundred million dust particles have not found a single living organism, independent of the fact that the majority of these organisms are not entirely without bad effect and sometimes are of use.

Besides this common dust, there is a special kind of dust whose constituents have a peculiarity of carrying an electric charge. These particles are called ions and are so small that they can only be identified by the electric phenomena which they exhibit, as they are not visible through any microscope, no matter how powerful. These ions are present in much higher levels of the air than is common dust, which ordinarily only rises a few hundred meters, and at one thousand meters, is almost entirely missing, whereas at this level, thirty to fifty thousand ions to a cubic meter can be found, so that the ionized atmosphere apparently has an expanse of many kilometers. This is not at all wonderful, as these electric particles are a thousand times smaller than the finest particle of ordinary dust, so that they are (*Cont. on page 757*)


WATER LADEN AIR EXPANDING
SATURATED WATER VAPOR
WATER VAPOR CONDENSES ON DUST PARTICLES AND IONS
SMALL DROPS OF RAIN COALESCE TO FORM BIG DROPS
LARGE DROPS OF WATER— RAIN
WATER VAPOR RISING FROM EARTH AS INVISIBLE GAS
EARTH

At the left is illustrated what may be termed a water cycle. The water vapor rises from the earth and the water-laden air expands. This saturated water vapor condenses on dust particles and ions. These small drops then combine to form large drops of water which we know as rain.

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Pump Idea *that* Made *a* Fortune

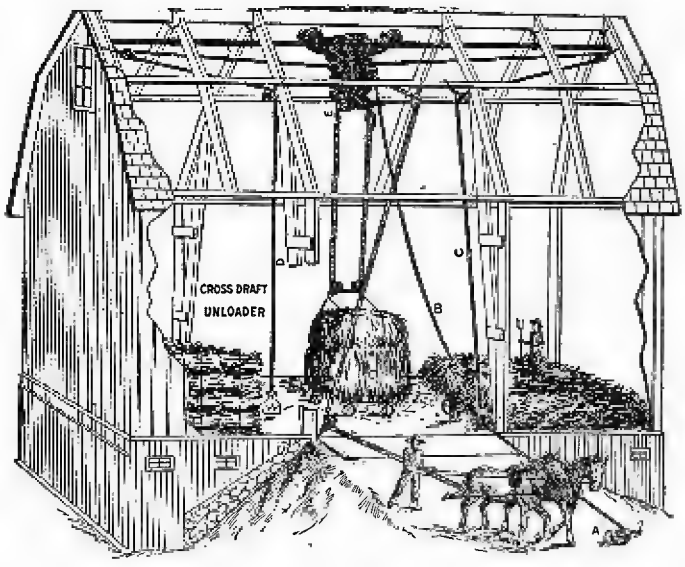
By

H. WINFIELD SECOR

How Philip A. Myers in Quarter of a Century Built Up Largest Farm Pump Business in the Country by Constantly Inventing Improvements in Pumps---A Lesson for Everyone.

Mr. Philip A. Myers, prolific inventor of innumerable improvements and original designs for pumps, hay unloaders and farm spraying equipment.

PICTURE for a moment a thriving and picturesque mid-western city—Ashland, Ohio—every work day morning when the factory whistle blows at the large pump and hay unloading tool machinery plant, organized and built up by Philip Andrews Myers,and his brother, the late F. E. Myers, hundreds of trained machinists and foundrymen wend their way to work. This great plant covers an area of twenty acres, and comprises the most up-to-date machine shops, pattern shops, as well as brass and iron foundries to be found anywhere. The company formed by the Myers brothers did a gross business last year of over five million dollars.

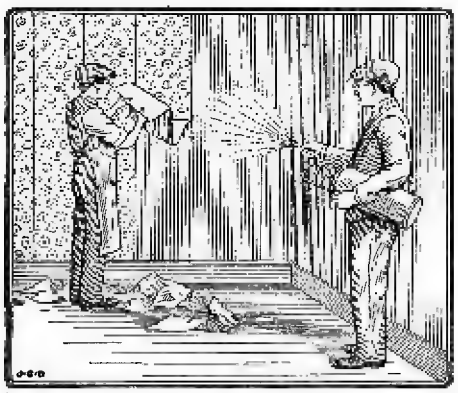


Picture above shows Mr. Myers' perfected design of hay unloader. The hay is unloaded from the wagons by means of slings passing around a large portion of the hay load. The horses raise the hay, and it is then pulled along to any desired spot over the mow. By pulling a trip rope, the load of hay is released and the mechanism then returns for the next load.

Building a Business Without Outside Capital

NO matter where you go in this or foreign countries, the chances are, wherever you see any form of farm pump or spraying machinery, hay unloading tools, etc., you will see the name of Myers emblazoned upon the tank or other part of the machinery. You will probably be greatly interested to know that this immense pump manufacturing business has been built up in a little over a quarter of a century—all from a simple basic pump invention conceived in the mind of Philip A. Myers. More remarkable still is the fact that the business was built up in this relatively short period without taking any notes or inviting any outside capital whatever, as Mr. Myers told the writer in a recent interview.

With all the hundreds of inventions this master-mind has conceived, coupled with all of the business worries which every man responsible for building up a growing concern has on his mind, Mr. Myers is today a fine example of a typical American business man. The great trouble with many business men is that they do not have a thorough grasp of all the details of the work going on in their plant. This frequently means a great loss in money and also in orders for the products their company manufactures. Mr. Myers shows on the one hand the true love of invention, which is apparent when he discusses his various inventions, and on the other hand, he also has a keen mind for the business phase of his organization. One of his good business ideas is shown by the method used in distributing the pump and other products throughout the world; Mr. Myers' company has its own extensive dealer organization.

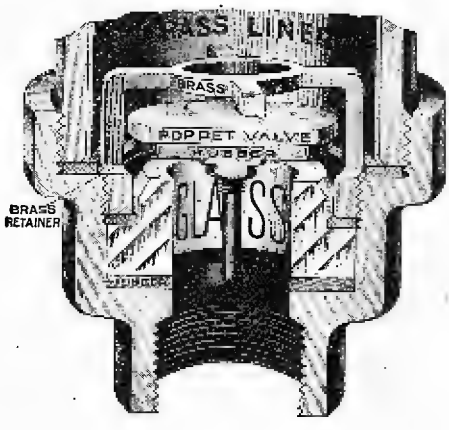


Among the many practical uses for the spray equipment devised by Mr. Myers is that of removing old wall paper, especially when several layers are to be removed.

History

LET us turn back the pages of Mr. Myers' history thirty years and see what

(*Continued on page 740*)



Cross-sectional view of the glass valve seat invented a quarter of a century ago by Mr. Myers, and which has revolutionized farm pump design. The glass does not corrode.

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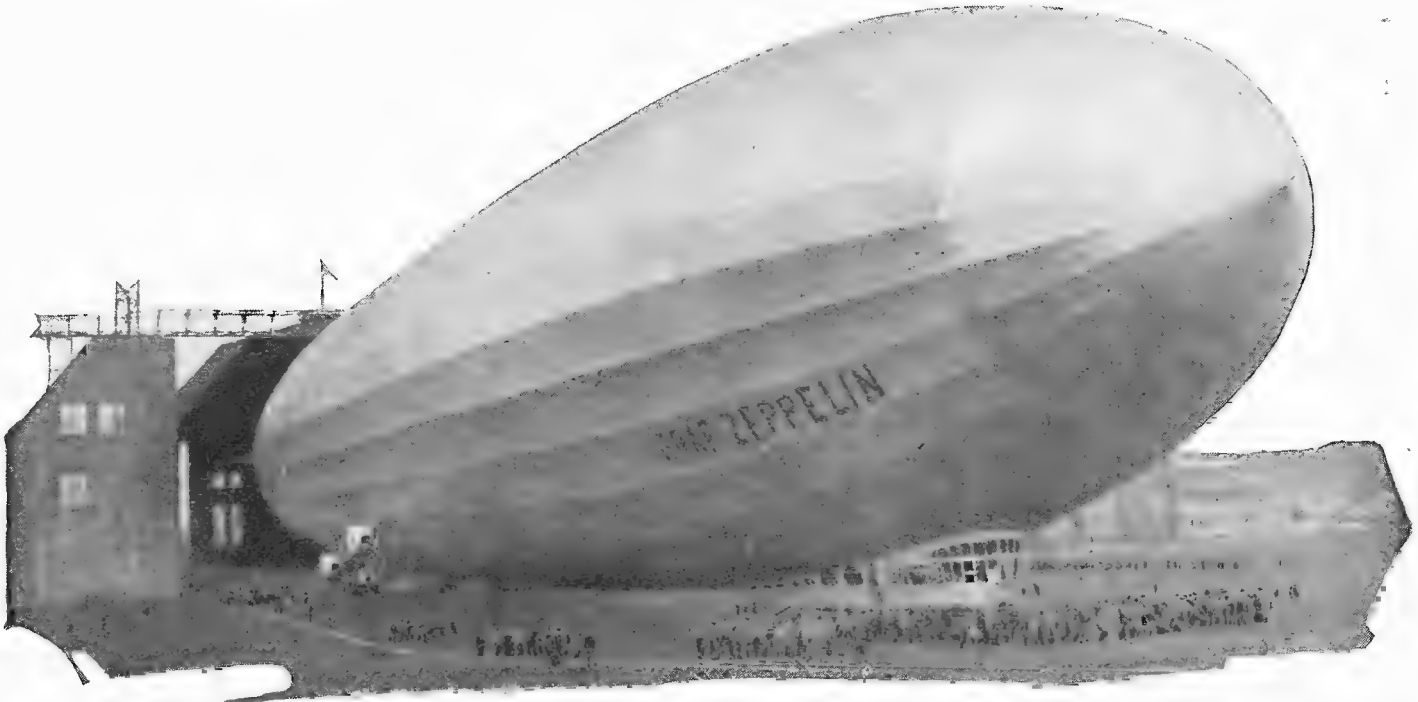
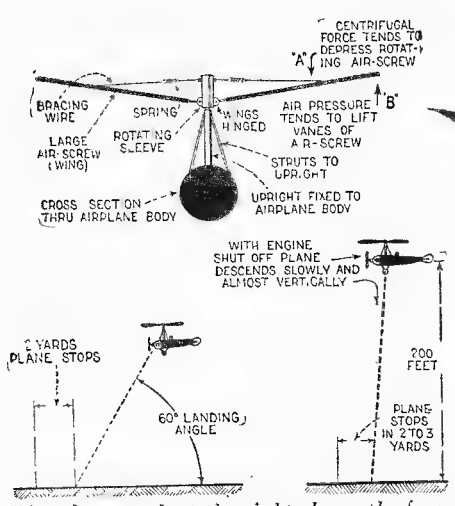


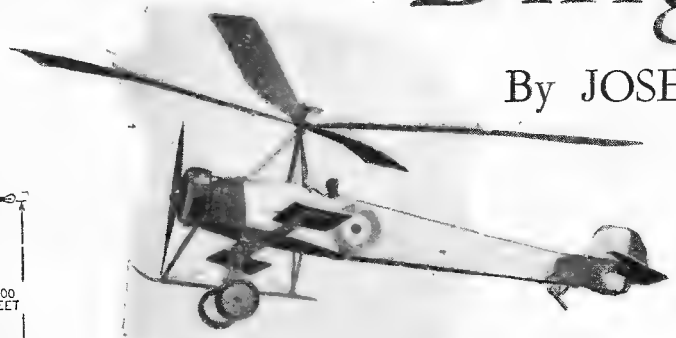
Here is the Graf Zeppelin, the new German lighter-than-air vessel, which by the time this magazine goes to press, is expected to have made its return across the Atlantic, in inaugurating regular fifty-hour inter-continental transoceanic travel. It is planned that this will be one of a series of vessels which will make regular voyages. Further details of this ship are shown elsewhere in this magazine. This shows the vessel as it was first hauled from the hangar.

Dirigibles

By JOSEPH H. KRAUS

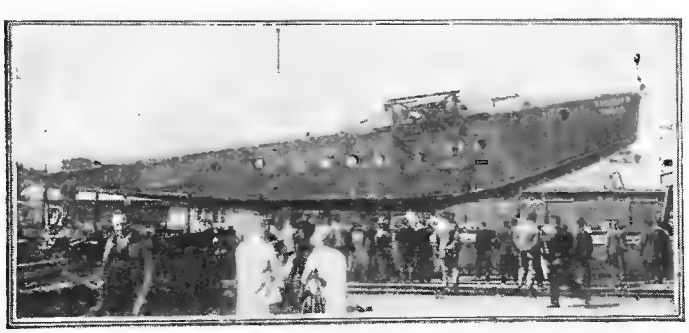
Many improvements in lighter and heavier than air craft.



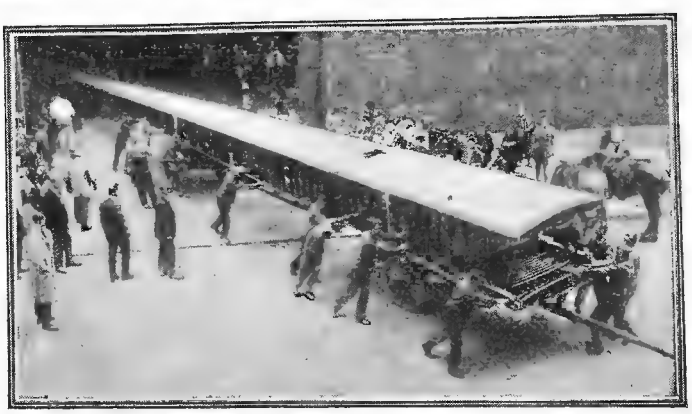


The photograph at the right shows the famous "windmill" type of airplane which only recently made its first flight across the English Channel; and above is the diagram which describes the action of this helicopter invented by the Spanish inventor, Senor de la Cierva. This diagram originally appeared in the January, 1926, issue of Science and Invention *Magazine, so the readers of this publication were told how this helicopter operated almost three years ago.*

EVERY day when we turn to the news columns of the papers we find that another rapid stride in aviation has taken place. Either a giant plane has been built or a new helicopter been evolved, or a lighter-than-air craft has demonstrated its sturdiness. Aviation is progressing forward at a speed far greater than any of its pioneers anticipated. No sooner do we learn that the Graf Zeppelin, a German air liner, is to be built, and to be



Here is the world's largest hydro-airplane being taken out of its hangar piecemeal, to be set together on the flying field. This hydro-airplane made its first flight recently. It weighs 18 *tons.*



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The French liner, the Ile de France, is provided with a catapult, by the aid of which an airplane will be able to take off from the deck, and thus shorten the time of voyage. Composite photo above shows a plane poised on the catapult just before it leaves the same.

and Airplanes

Time of Intercontinental Travel Being Steadily Shortened.

inaugurated in regular inter-continental travel, and no sooner is the material available for the readers, than the news flash comes over the wires that the Zeppelin is ready for her maiden flight.

Elsewhere we find in this same issue an article giving the complete details of construction of the Graf Zeppelin, and showing the spacious and well-equipped accommodations for the passengers. It is planned that this lighter-than-air craft will be able to make bi-weekly flights, greatly shortening the distance between Europe and this continent.

As we go to press we notice that the Graf Zeppelin left Germany at 1.30 A. M., our time, October 11th, and arrived at Lakehurst Field on Monday, Ooctober 15th, at 5.39 P. M. The total elapsed time for the flight was (*Continued on page* 777)

Left—New advertising scheme and, below, aerial beacon.

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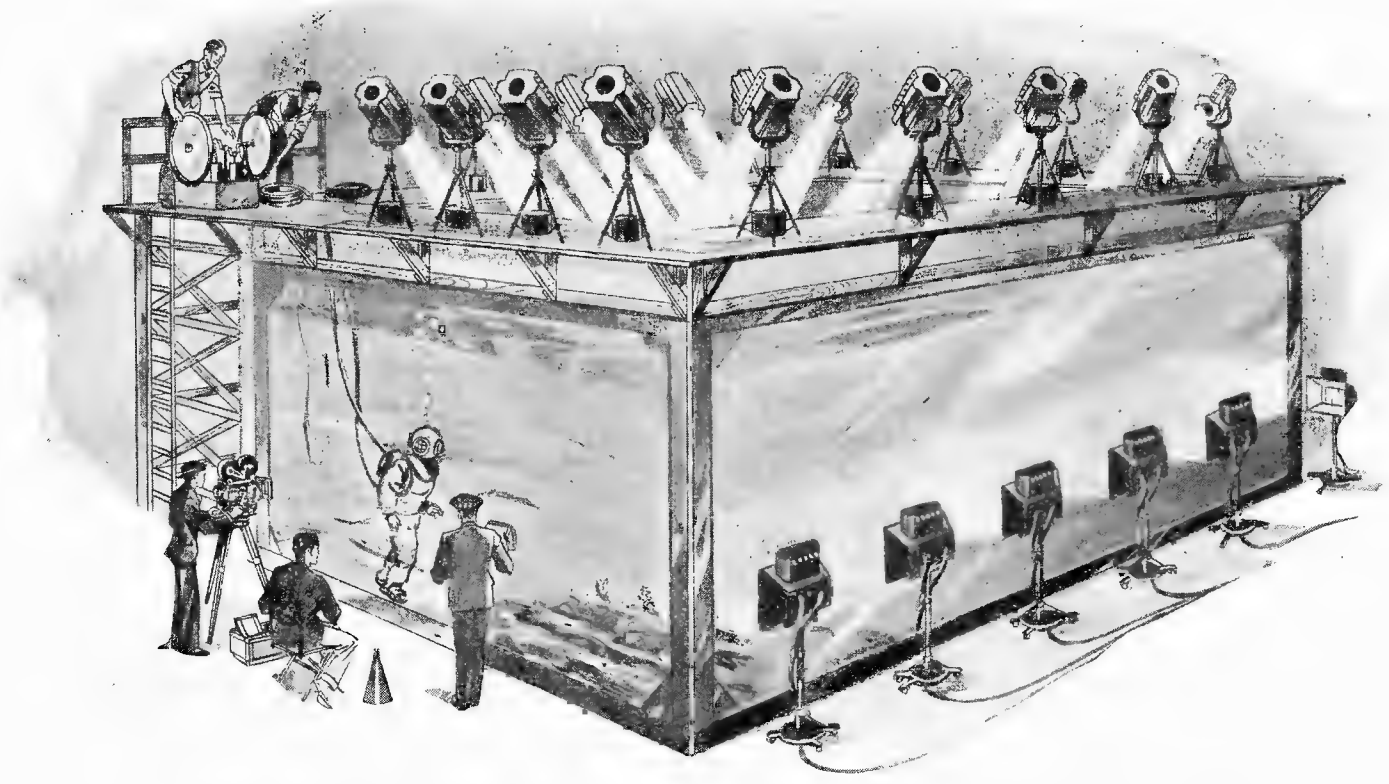

The illustration above shows the huge glass tank which was constructed in the studio for filming the photoplay "Submarine." This measured 16 ft. square and the necessary sets were erected in it. The cameras were set up outside of the tank and the requisite number of lights distributed about the set as illustrated. No lights were used on the side toward the camera because of reflection.

Filming Submarine

Fig. 1. A diver is approaching the conning tower of the sunken submarine in order to attach an air hose. This section of the vessel was built in the tank.

Fig. 2. Below shows a close-up of the diver and how the upper side of his equipment is illuminated, while the front is in darkness. The lights were placed around the tank but not on the camera side, as can be seen in this view.

IN *"Submarine"* we have Hollywood's dramatization of recent submarine disasters. As a picture it is interesting, dramatic, and above all, entertaining.

From the scientific angle, it is interesting to analyze some of the problems met in filming the underwater scenes and the scenes inside the submarine. For many years we have had devices presented for taking underwater photographs, and many of them are ideal for use in scientific research and certain kinds of underwater dramatic production. With the task of presenting a play with the story angle paramount, the producers realized that actual submarine filming at great depths would hamper the telling of the story, putting it in second place in reference to scientific achievement. They decided on the tank method, nearly as expensive but more certain of results. A huge glass tank, sixteen feet on each side, was constructed in the studio. In this tank were built the necessary

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Tricks Used in Taking A Sub-Sea Moving Picture

Large Glass Tank and Scale Models Among the "Props" Used Are the Hints Given to Amateurs to Enable the Duplication of Tank Scenes Shown Here.

Fig. 6. The photograph at the right shows an interior shot of the submarine, which was taken from an exact reproduction of the original craft.

Disasters In the Movies

By DON BENNETT

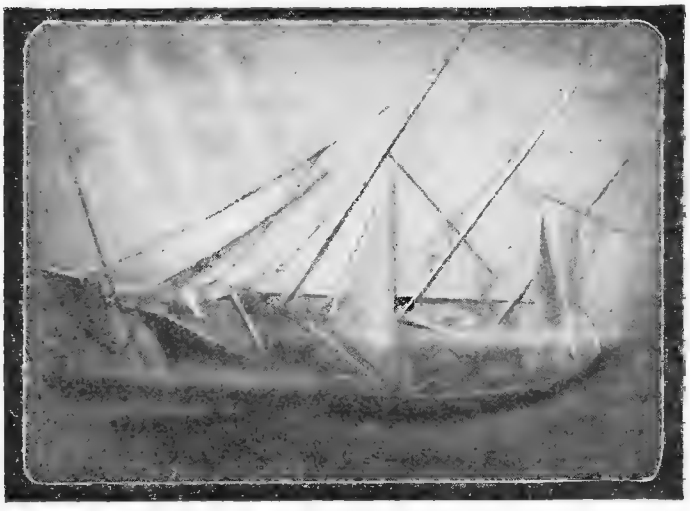

Fig. 4. Another model was used in the filming of the above. A schooner with tattered sails and fish swimming in and out of the hatches and companion way reposes on the bottom of the "sea."

Fig. 3. Below shows the submarine slowly sinking. This was accomplished by building a scale model and feeding compressed air into it. The air escaped through holes and rose to the surface slowly.

sets. The cameras were set up outside the tank, and the requisite lights and other paraphernalia were distributed about the set.

How Diver Was Photographed

THE story involves, among other things, the attaching of an air hose to a sunken submarine. In the illustration (Fig. 1) we see the diver approaching the conning tower. This section of the vessel was built in the tank, a duplicate of that part of a real submarine. To show the diver going down through the water, this background was removed from the tank, and the diver simply dropped down into camera range, and beyond it, into the depths.

This, of course, is a much simpler process than using a diving bell or similar apparatus in deep water but, nevertheless, it has its difficulties. Plate-glass picks up every tiny reflection and throws it right into the lens, needless to say, a very undesirable effect. To overcome this, (*Continued on page* 771)

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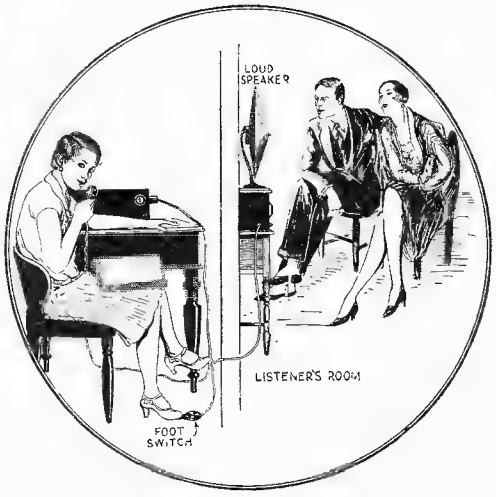
Movie Stars Try Out Voice for New Art

"Talkie" Voice Tests

Apparatus Used Includes Microphone Amplifier and Loud Speaker Through Which Voice Is Reproduced

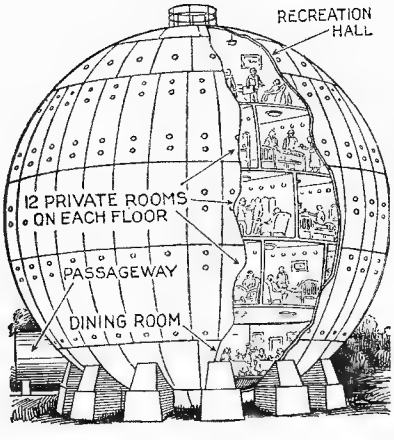
The above photograph shows a well-known screen star having her voice judged for the talking movies. Note the foot switch.



The drawing at the left shows how the tests are conducted, with the subject in one room and listeners in another. A foot switch is provided for cutting the microphone in or out of the circuit.

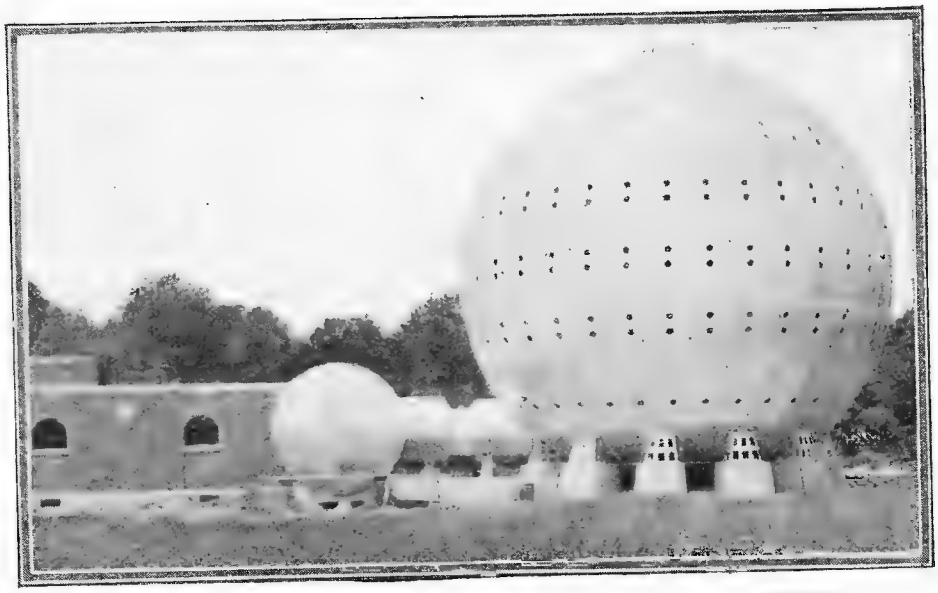
MOVING picture actors must have a good recording voice for the talking pictures. The silent drama has found its voice and the star must not only act but speak properly. One of the tests now being used is to place the star in one room with a microphone and a suitable amplifier, or in some cases the amplifier is placed in the outer room. A foot switch enables the microphone to be switched into the circuit for speaking. The output is led to an audio amplifier and loud speaker placed in an adjoining room, where the judges sit.

Air Pressure Battles Diseases



The drawing at the left shows the general construction of the steel spherical house, and the photograph below gives a view of the huge sphere and of the cylinder through which the patients will enter.

AIR pressure will now be used in battling diseases such as diabetes, pernicious anemia and the like. For carrying out the cure a huge steel ball has been erected and fitted with complete hospital equipment. It is air-tight and will be supplied with air under 30-lb. pressure per square inch. Patients will first enter a long cylinder and the pressure will be increased gradually until they enter the ball. The million-dollar sanitarium, as it is called, is 64 ft. in diameter and five stories high. The cylinder is 10 ft. in diameter and 9 ft. high.



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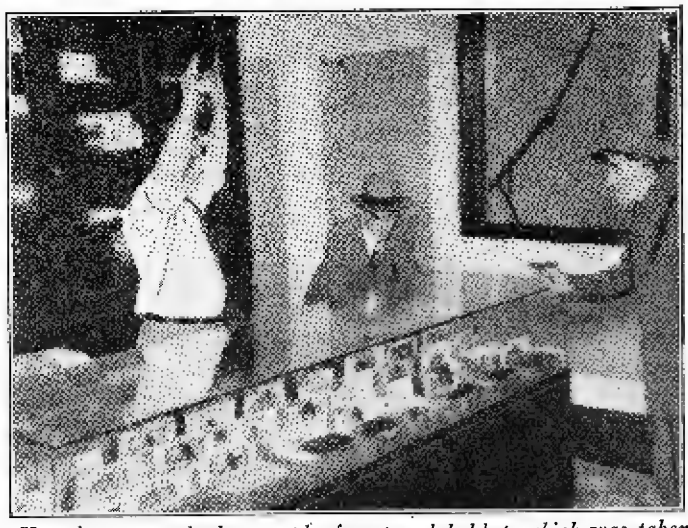
Foiling *the* Holdup Man

By JOSEPH K. LONDON

Two Novel Systems to Aid in the Apprehension of Criminals, the First Registering the Holdup and the Second, Sounding An Alarm



Here is an actual photograph of a staged holdup which was taken by an automatic camera, located in a steel box near the back of the store. Of course, the thief does not know that his photo is to be taken until after the flash. He cannot destroy the box or ruin the film unless he also carries cracksmen's tools with him.

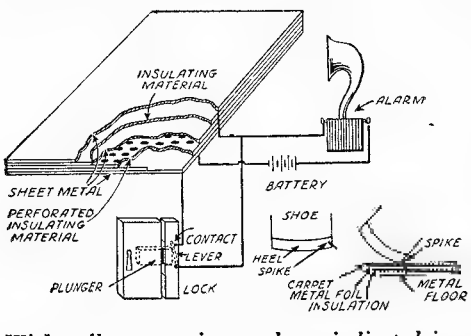
MANY attempts have been made to foil the petty thief as well as the holdup man. All sorts of electrical circuits and systems have been employed, and yet offices and stores are not theft-proof.

One of the latest systems does not interfere with the burglar in any way whatever, nor does it sound an alarm which will give the thief time enough to shoot his way out. If he holds up a store fitted with this thief detector and if the outfit is put into operation, he knows that the "jig is up." He knows that his activities have been recorded permanently and if he makes any attempt to use the gun, he will be directly responsible for his crime.

Essentially the method is this: A camera is placed at some proper point in the store so that a view of the entire store can be obtained. This is housed in a steel box. Alongside of this box there is a flashlight gun fitted with an electrical release. The steel box of the camera has an aperture in juxtaposition with the lens. In back of this aperture there is a gravity type steel shutter, or one operated by a spring. This shutter is likewise electrically released by the action of a solenoid. Many ingenious methods for actuating this solenoid can be worked out.

Here is a method of sounding an alarm in such offices where it is impossible to place a contact rail. It affords freedom of movement all about the office, yet at any instant an alarm can be sounded. A spike at an angle imbedded within the heel closes the circuit between two metallic plates when the heel is turned on a side.

Supposing now that the holdup man enters the store fitted with this apparatus. He orders the individual behind the counter to throw up his hands and this the clerk in charge promptly proceeds to do. The clerk's foot, however, moves forward so that it comes in contact with a rail extending from one end of the counter to the other. This rail closes the circuit and operates the solenoid controlling the flashlight. At the same time, the camera shutter is released. The photographic plate has thus recorded the holdup and taken a picture of the individual or individuals participating in it. This photograph can be turned over to the police for their further action.



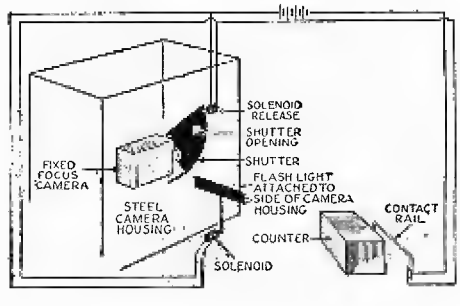
With a floor covering made as indicated in this diagram, it is possible to sound an alarm from any point in the room. The heel spike closes the circuit.

The photograph on this page shows such a staged holdup and the results which were actually obtained by the camera automatically set off by the clerk.

In the method described, as with many others, it is necessary that the clerk be facing the counter and that his foot be within reach of the contact rail. Such a means is not always possible. With this end in view, Samuel M. Kalikow, a New York inventor, has designed an anti-theft system which is admirably suited for offices where it would be impossible to put up any sort of a contact rail.

The manner in which this method operates is quite easily explained. The carpet on the floor or the linoleum is relatively thin. Immediately beneath that there is a layer of thin metal foil, such as, for example, copper foil. Then comes a layer of insulating material, and a last sheet of metal. It will be observed that the various layers of metal foil are connected with an alarm in the form of an electrical siren and also with an electrical door lock.

What actually happens is this: Imbedded within the rubber heel of a shoe, and at a slight angle, the inventor has placed a steel spike. This spike ordinarily does not project from the heel at all, nor does it interfere in any way with the person's walk. When the holdup man enters, his command is promptly obeyed. The only shift in position on the part of the victim is that he turns his ankle over and exerts a little pressure on the heel. This causes the spike, imbedded within the heel, to protrude slightly and puncture the two layers of metal foil, closes the circuit and sounds the alarm. This is simple and of low first cost.



This is a diagram of the system for taking photographs unknown to a thief. It is applicable to home or store protection.

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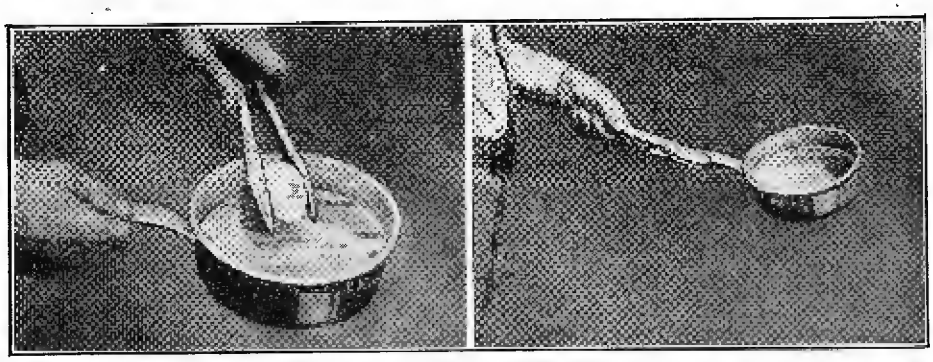
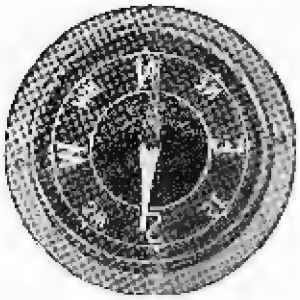
New Time-and Labor-Saving Articles for the Home

Latest Devices

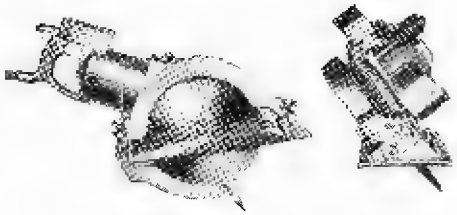
New Inventions Help to Lessen the Household Duties. The Home Owner and Housewife Will Find Much of General Interest Illustrated on These Pages.



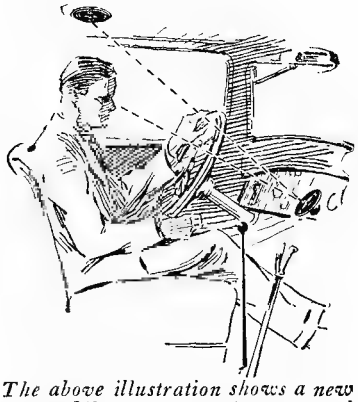
Metal tongs for handling hot things in the kitchen will now keep the housewife from burning her hands and may be used for handling hot pans or removing articles from boiling water. Two uses are illustrated above.—A. P. Child.



The above photo shows a view of a new automobile compass.

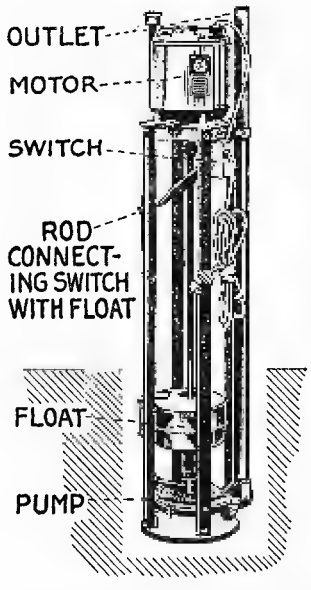


The above illustration shows a new portable electric hand saw which can be used for bevel sawing up to 60 degrees. Each saw is furnished with an 11 inch and a 9 inch blade. It can be used for vertical sawing for any width up to six inches. With the "width gauge" various sizes of strips can be cut without marking.

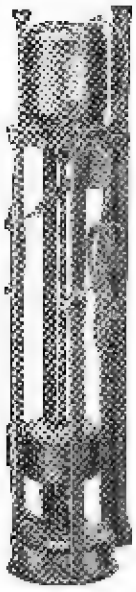


The above illustration shows a new automobile compass with reversed lettering. This is attached to the top of the car and is seen in the dash reflector as shown by dotted lines. The letter under the white point of the needle indicates the direction being taken by the automobile.

A new sugar dispenser which when tilted pours forth exactly one teaspoonful of sugar is illustrated above. A photo appears below.



The drawing above shows the construction of an automatic cellar drainer which has a capacity of 2,500 gallons per hour.



An automatic pump which drains the cellar automatically, when the slightest water seeps in, is illustrated above. It is simple in action and connects to any electric light socket. The annoyance and unhealthy condition of damp basements can now be eliminated.

Names and addresses of manufacturers supplied upon request.

Above—the cap and container fitted with rubber base.

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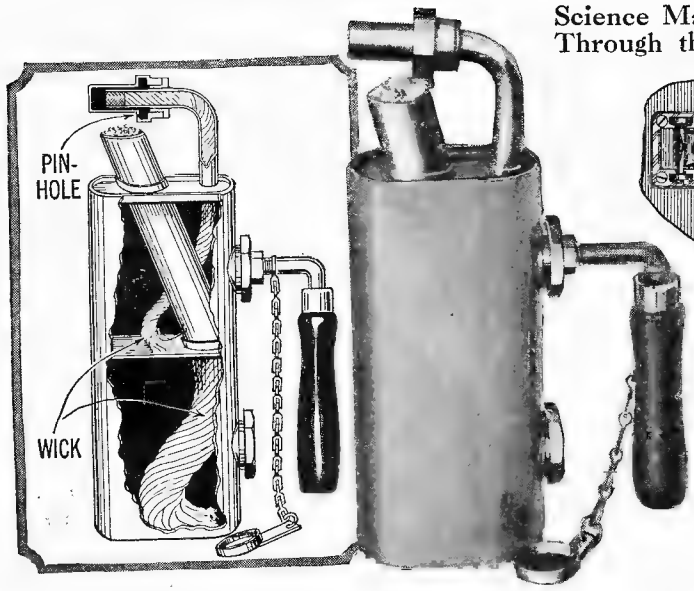
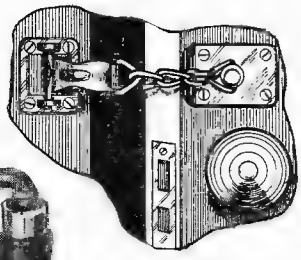
to Lighten Labor

Science Makes Our Modern Existence Easier Through the Development of Countless Aids.

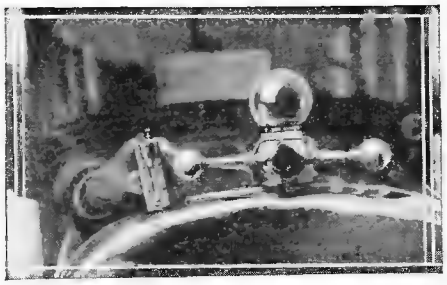


A new automatic alcohol blow torch has recently been placed on the market and is shown. The cap locks in place when not in use.

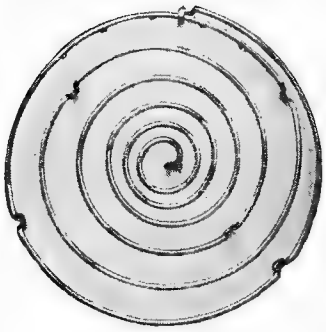


A new anti-burglar lock and chain permit the door to be partly opened and yet secure at the same time, thus preventing intruders from forcing an entrance.

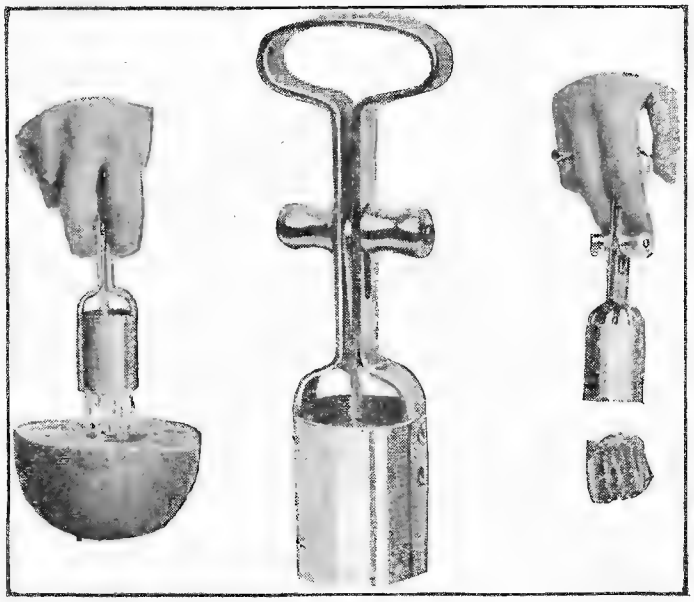
A support for books, papers, and the like, appears above. It is readily folded and therefore easily portable. The angle of the rest can be adjusted to suit the individual. The rear portion of the base is counterweighted so as to balance the weight of the book.



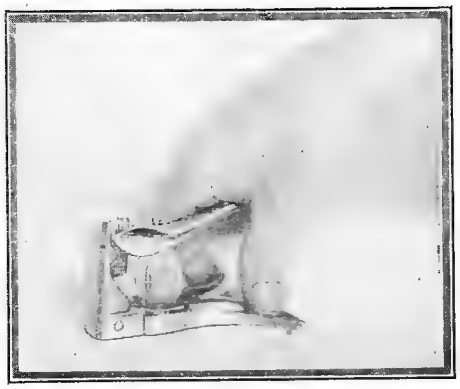
Seen in the above illustration is a new automobile accessory. This is a small thermostat placed in the radiator which rings a warning bell when temperature of water rises.



Illustrated above is a new aluminum cooker which enables vegetables and meat to be cooked without the addition of any water. The articles rest upon a grill also shown above and are boiled or roasted in their own juices.



A specially formed sharp edged shell scoop permits the removal of grapefruit cores as shown at the left. The two knobs are raised and shear off the bottom of the core and press out the juice. When the knobs are lowered, the dry core is ejected. The sharp edge of the scoop crosses the lower inside diameter of the tube and acts upon the grapefruit core.—A. P. Child.



A handy nut cracker requiring little pressure is shown above.—A. P. Child.

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Gas Enables Crew of Disabled Submarine to Quickly Signal Surface.

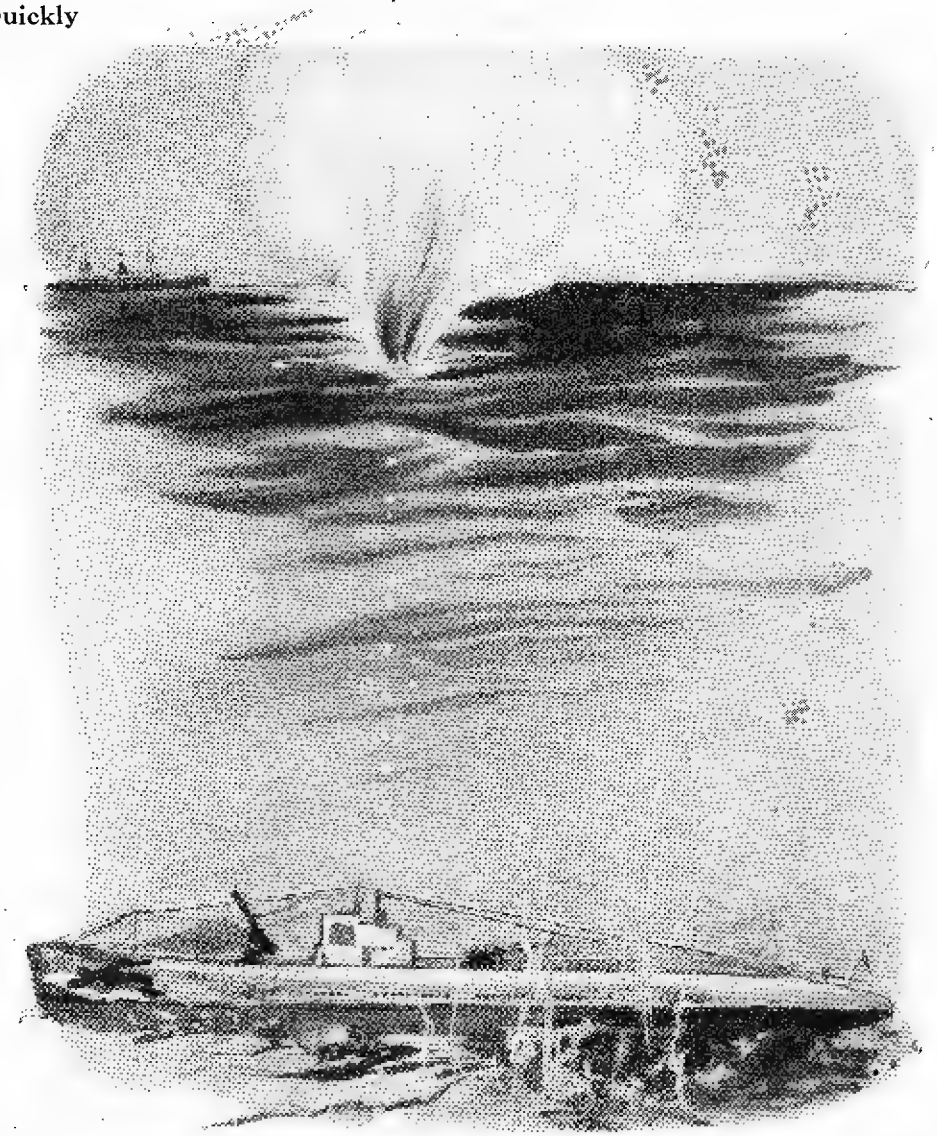
Flame *and* Smoke Signals *for* SUBS

A HEAVY white column of phosphine gas smoke rising from the ill-fated S4 submarine might have averted the recent marine disaster, in the opinion of Prof. Frank C. Mathers, member of the U. S. Chemical Warfare Staff in 1918, and professor of chemistry at Indiana University.

From use of phosphine to trace the path of torpedoes during battleship target practice, and since phosphorus smoke was found during the world war to be the most effective smoke screen chemicals developed, Dr. Mathers concludes that the phosphorus compound known as phosphine might be used as a means of identifying the position of submerged underseas craft.

Submarines might carry supplies of inexpensive calcium phosphide, according to Dr. Mathers. When water is added to this substance, phosphine is formed. This chemical is spontaneously combustible when it comes in contact with air.

By day the identifying signal would be seen as a dense white column of smoke and by night it would appear as a column of flame.—*Frank R. Elliott.*



This view shows what will take place if the new method of signalling is adopted. The crew of a disabled submarine can quickly signal the surface, giving its location, and can also use the flame and smoke signal for sending messages in the continental code. Cans of calcium phosphide can be distributed in the different compartments. When water is permitted to come in contact with the chemical, phosphine gas is produced which, coming in contact with air, bursts into flame and produces a dense white smoke.

CAN YOU ANSWER THESE QUESTIONS?

Form Your Own Answers Before Turning to Page Indicated

1. From your study of the subject and possibly your experience in mating animals, etc., do you believe that it is possible to control sex? (See page 682.)

2. Do you think that subways fifty years from now will be in the form of moving platforms, cars of the present type rolling on wheels, or closed projectiles shot through vacuum tubes? (See page 686.)

3. Do you think it is possible for the human stomach to consume several gallons of liquid, and that a magician could then place his mouth to a fountain inlet and cause the liquid to pass out through the fountain from the stomach? (See page 689.)

4. Did you know that thousands of pumps are now being built with solid glass valves in them? (See page 699.)

5. What do you know about the length, diameter and passenger-carrying capacity of the Graf Zeppelin? (See page 690.)

6. Does a dollar bill have a longer life today than it did in 1910? What becomes of old worn paper money? (See page 692.)

7. How can television be applied to produce pictures in color, in relief and also accompanied by voice for public theater use? See page 694.)

8. Why do we need rain; or do we actually need it at all? (See page 698.)

9. Do you believe compressed air can be used for the treatment of diabetes and pernicious anemia? If so, how do you suppose it will be applied? (See page 704.)

10. Do you know how to make a good water-proof cement from two cheap well-known chemicals? Do you know how to make a simple yet effective glue? (See page 716.)

11. How do you explain the fact that oval wood handles or hammers are turned in a lathe, in which ordinarily true cylinders are turned only? (See page 721.)

12. Name three ways to drive a television disc by means of a motor. How can different numbers of holes be accomodated all in one disc? (See page 728.)

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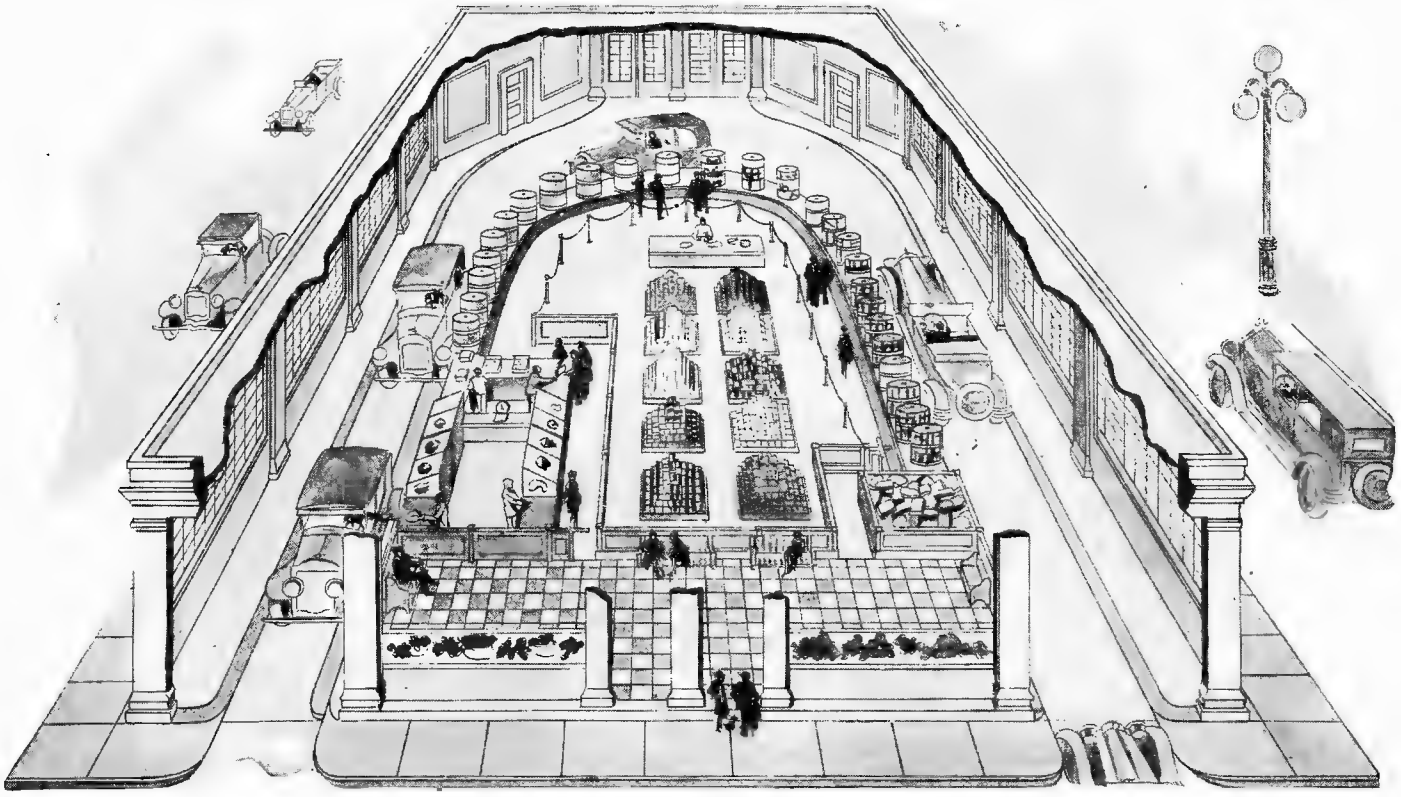

Shopping Without Leaving Your Auto

New Auto Market Facilitates Purchasing

ONE of the most unique systems for facilitating shopping and purchasing is the idea illustrated in diagrammatic form on this page, and also shown in the photographs. This has appropriately been called the auto market.

It operates approximately as follows: On either side of the market, there is a driveway. The motorist who wants to drive into the market turns into the entrance at the right and then slows down to almost a crawl. He reaches out of the window of the sedan or out from the side of his touring car, or any other machine that he may have, and picks out those articles of foodstuffs which he requires. Most of them are, of course, wrapped up in convenient packages. The foodstuff is deposited in a tray moved along at the purchaser's will, on a roller conveyor.

The motorist does not need to worry about the ventilation, because this has been taken care of by the designers of the market. Giant exhaust fans provide a constant stream of air (heated in the the winter time) to diffuse any possible carbon monoxide gas accumulation. Consequently, the motorist can take as long as he desires in the selection of his material. Meanwhile, any pedestrians can wait upon themselves from the counters, and the revolving tables are conveniently arranged. As both pedestrian and motorist leaves the auto market, his purchases are checked up by the cashier at the point of exit and he pays for his purchases there. Just in front of this place there is the meat market, so that while a cashier is checking up the products, the butcher takes care of the meat order.

This gives a view of the revolving tables from which either pedestrian or motorist may choose whatever aricle of canned food stuff or bottled material he may desire.

An interior view of the automobile market in which both pedestrians and motorists are served. The photo shows purchases being checked up.

Market expedites the purchase of and the transportation of food and caters primarily to the motorist, who need not even leave his automobile.

This photograph indicates with what facility pedestrians and motorists are able to help themselves to the materials on the display counters.

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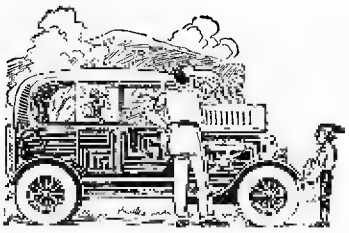
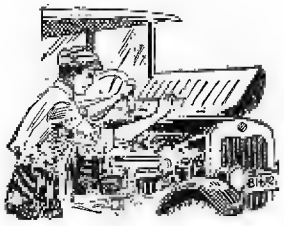


MOTOR HINTS

Conducted by GEORGE A. LUERS



Valuable Hints for the Car Owner During the Cold Winter Months

Radiator Heater for Cold Garage

A GARAGE heater of the type shown in the attached sketch serves to remove one of the major difficulties of winter automobile operation. Through use of this the engine can be brought to a temperature where it will start quickly and without running down the starting battery.

This heater is made from plyboard, forming a box for a bowl type of reflecting electric heater. Above the box is a hood projecting forward to divert the heat against the automobile radiator.

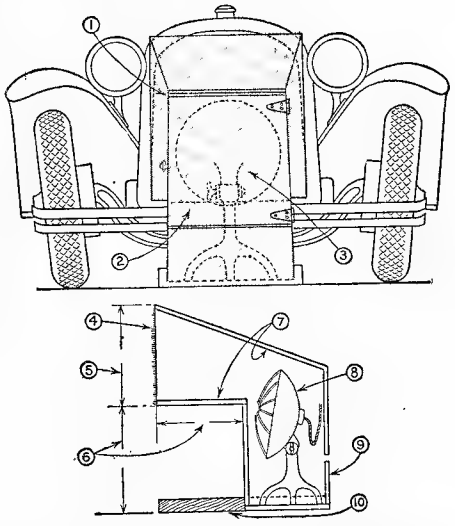
The inside of the casing is lined with sheet asbestos, to conserve the heat and also as a protection against excess heating and warping of the wood. A small hinged door in the box facilitates removal of the electric heater.

The edge of the hood, abutting the radiator, is fitted with a felt strip. The hood should be the approximate shape of the radiator.

Not only will this heater serve to keep the motor warm but it is an aid to personal comfort when some part of the car requires adjusting during the winter months.

DO YOU KNOW—

spark plugs when used for a long period are useless, due to the porosity of the porcelain and produce the following troubles: (A) Oil pumping, with carbon; (B) Hard starting, and drain on battery; (C) Difficulty in driving slow or accelerating; (D) Higher gasoline consumption; (E) Loss of power on hill-climbing, especially; (F) Increase need and expense of repairs.



In the above illustration: 1, *shows heater in use;* 2, *small hinged door;* 3, *electric heater;* 4, *felt edge;* 5 *and* 6, *show dimensions which depend upon the size of the heater used and also the type of automobile;* 7, *asbestos lining;* 8, *electric heater;* 9, *thin wood back;* 10, *supports.*

Adjusting Four-Wheel Brakes

Instructions are invariably given in reference books supplied with each make of car for adjusting the four-wheel brakes. The several nuts that are to be turned to decrease the band clearance are pointed out, along with instructions for making the pedal movements and the equalizer bar movements correct.

The general instruction to "adjust the brakes so the right and left brakes in each set hold alike," is most important and must be followed if the desired results from the brakes are to be obtained.

A specific method of determining when the right and left brakes from each set are holding alike, is shown in the attached sketch. This means was devised and is used by the foreman of a taxi service station for use on taxicab brake systems. Inasmuch as only a spring balance scale is used, the average owner can employ this advantageously and simply in adjusting the brakes of the private car.

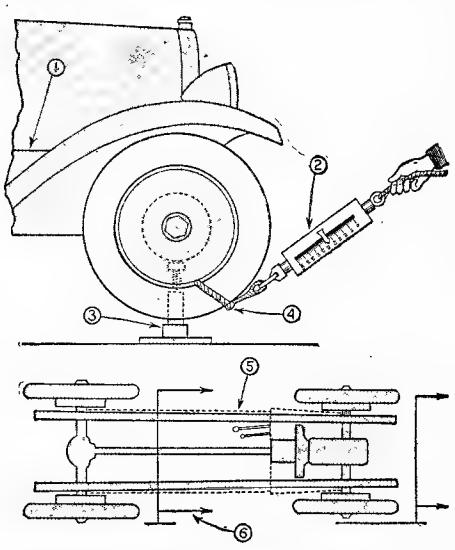
To describe the method, all four car wheels are jacked off the floor first. Brakes are set up, using the procedure in the instruction book. The brake pedal is pushed down and held with a notched stick, this stick being supported at the rear end by the edge of the car seat.

A rope or cable is placed around the tire and the spring balance used to slip the wheel in the brake. The load required is registered in pounds. Make the necessary adjustments of each brake such that this load will be the same for each, and the brakes are then equalized.

How to Avoid Winter Car Ailments

Now is the time, before the bleak cold weather sets in, to make the necessary adjustments and prepare the car against ailments which come with the snow and cold.

The important details are shown in the accompanying illustration, all of which details are vital in avoiding trouble which follows neglect. Winter drives are usually short; however, troubles, inclusive of frozen cooling systems, starting failures, broken springs, missing engines, discharged and frozen batteries, fuel failures, burned-out bearings, etc., are frequent.



Above: 1, *indicates brake pedal secured in fixed position;* 2, 100-*lb. spring balance;* 3, *wheel jack;* 4, *rope or cable;* 5, *indicates plan view of chassis, and* 6, *indicates that brakes are adjusted until test on wheels shows an equal load to slip the brake.*

There are eleven major items of preparation to consider and these items are described more fully in the following order:

(A) The lubricant in the differential and transmission should be flushed out. It is undoubtedly dirty and filled with particles of metal after the long touring season. A fluid gear oil should be used to refill the cases. This should be fluid enough so that the gears will not cut tracks in it, when cold, but will flow and fill between the gear teeth and enter the bearings. Some manufacturers recommend the use of high-grade heavy body motor oil which will flow at low temperature. This oil meets the need for an oil to flow and fill in the gears and the bearings.

The life of an engine depends upon the care given to it. The principal problem in its upkeep is lubrication. If proper lubrication is maintained, the major portion of the work needed to keep an engine in good condition has been accomplished. It is not enough to place lubricating films between surfaces, but they must always be kept there in order to prevent loss of power, wear and binding.

(B) The battery is a weak link in the system, and most important are the terminal connections. If examination shows the ground wire slightly broken, renew this. Heavy grease helps keep verdigris from the terminals. The battery case and hangers may show acid corrosion and, if so, these should be cleaned with ammonia and the case and supports should be coated with black asphalt paint. (*Continued on page* 744)

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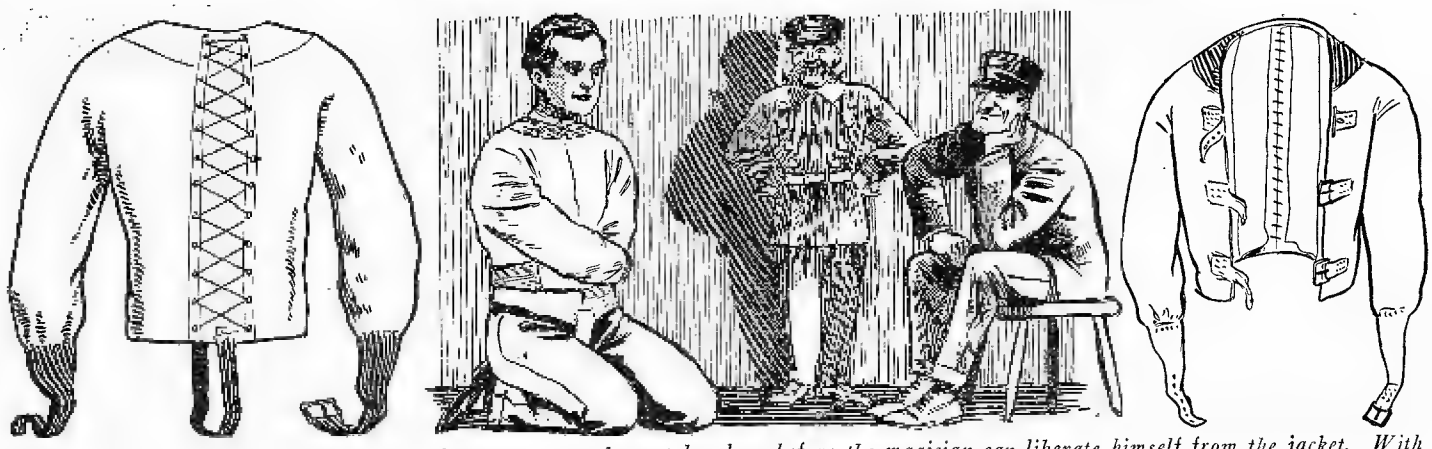
MAGIC By "DUNNINGER"

NUMBER SIXTY-FOUR OF A SERIES



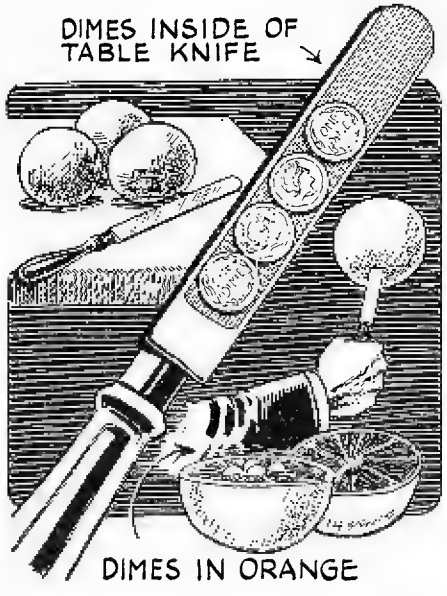
In the usual straight jacket releases, much strenuous work must be done before the magician can liberate himself from the jacket. With this jacket a lace permits the jacket to expand, aiding freedom.

Improved Straight Jacket Release

THE magician who has heretofore favored the effect of liberating himself from the regulation straight jacket has, in all probability, eliminated it from his program, due to the strenuous manual labor which was necessary to effect his escape. In this improved trick, the straight jacket has an extra pleat sewed into the back, which is, of course, covered from view, by an outer and inner layer of cloth. This additional space is drawn together by means of a strong lace, as illustrated. The lace is held firmly in place by two small hooks, held to two rings, sewed upon the lower edge of the jacket. As the magician is strapped into the affair, his trained assistant secretly releases these laces, during the operation of adjusting the final strap between the conjurer's legs. As the wizard rolls about the floor, the jacket secretly expands, making it a simple matter to slip it over his head. The rest of the effect is carried out exactly as in the usual straight jacket release; namely, one arm is first forced over his head, and this is subsequently followed by the other arm.

Rapid Transit Dimes

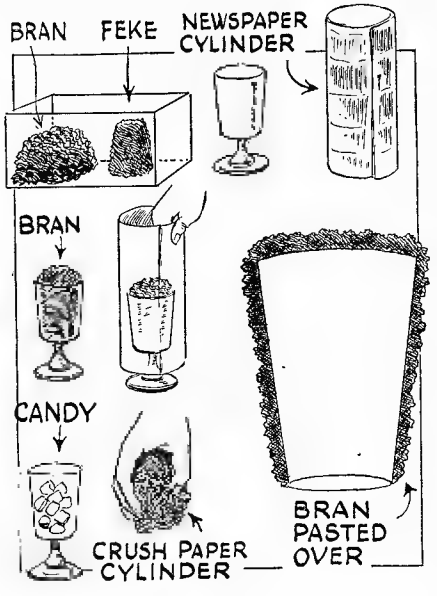
THIS method of presenting an ever-popular effect will give the amateur wizard an opportunity of duplicating what is apparently the outcome of years of practice. Four dimes are made to disappear by any of the methods which a magician usually employs, or any of those described in previous articles of this series. On the table or on a tray, the spectator will find a group of unprepared oranges, any of which he may examine at will, and then present to the magician. The wizard cuts a gash into the fruit, then completely splits it. On opening the pieces, the dimes will be seen to have found their way into the interior. The secret lies in the construction of the knife, the sides of which are made of thin steel, and so arranged that they form a compartment for the holding of the dimes. The first part of the cut into the fruit is made in the ordinary way. After that, the knife is tipped upward, so as to permit the dimes to slide out of it, and distribute themselves about the cut.



In this effect any one of a group of oranges is selected by a member of the audience. This is examined to prove that it has not been tampered with. The magician then picks up a knife from the table, cuts into the fruit, which on being opened, reveals the coins.

Bran to Candy

THIS is a vast improvement over the old experiment of a somewhat similar effect. It will be remembered that in the old stunt the performer fills a goblet with bran, and empties it, to prove that the glass contains nothing but bran. This is done several times, after which the container, apparently full of bran, is covered with a metal cap which, on being removed, discloses the glass full of candy. In this modern version, instead of using a metal cover, a cylinder of paper is employed which, on being removed, is crushed up and thrown away. The effect is produced by the aid of a paper feke (instead of a metal one), made to fit the container. To this a thin layer of bran has been glued. This feke contains the candy and it is loaded into the glass goblet under pretext of filling it with bran from the box. The feke is removed with a newspaper cylinder, leaving the candy behind. The feke is then crushed in the newspaper and thrown away.



In this effect a goblet of bran is converted into one full of candy. A paper feke covered with bran which contains the candy, is employed. The feke is crushed in the newspaper cylinder and thrown away.

Amateur magicians often lose sight of the fact that to put over any trick well, whether for private or public performances, there is invariably required a good patter or "side talk." In many cases the change or pass in a certain trick is accomplished while the performer is speaking some such line as, "Now watch my hands closely; the hand is quicker than the eye." The audience watches sharply, but the trick or pass is made so skillfully, under the cover of some "camouflage" like the above, that they do not see how it is done.

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Awards in The $500.00

More Than 7,000 Readers Enter Contest

IT will be remembered by the readers of SCIENCE AND INVENTION Magazine that the September issue of this publication had a peculiar and most unusual cover. This cover, a photograph of which appears on this page, contained 48 scientific errors. The readers were asked to find those errors and list them, and a total in prizes of $500.00 was posted for those who discovered the greatest number of scientific mistakes.

The rules of the contest indicated that the errors were only of a scientific nature. Errors such as the color of the sky, or the color of the sun were naturally discounted because in three-color reproduction of magazine covers, the correct color value cannot always be reproduced, nor is it possible to say with a finality, that the sun cannot have the color indicated in the original cover.

As an example of what constitutes a scientific error, the editor pointed out that the man in the foreground is smoking a cigar. There is every indication that a strong breeze is blowing, yet the smoke from the cigar rises straight into the air. The readers were asked to make their answers just as short as possible in order to facilitate the work of the judges.

Here is a reproduction of the September cover of SCIENCE AND INVENTION *Magazine which contained the 48 scientific mistakes, for the discovery of which awards totaling* $500.00 *were posted.*

Contestants Tie for Awards

WHILE there was no question in the minds of the judges as to the prize winners in the first groups of awards (the line of demarcation here was very distinct), the fortieth award of the eighth prize had eight additional runners-up.

These contestants could have been ruled out from the standpoint of neatness, which was one of the conditions of the contest, but the judges decided that inasmuch as these rated the same percentage they too should be entitled to a duplicate of the prize tied for.

Thus the contest closes with a list of 81 prize winners instead of 73 originally announced.

Contestants Cooperate

THERE were many evidences of cooperation among those who tried for the prizes.

Many contestants mentioned each and every shadow as a separate error. In the list of answers which follow it will be observed that the shadows are classified under one heading.

Now this is another point which should be particularly stressed and carefully noted by everyone of the many who took part in this contest. Each and every error was located, and the number of times these errors were noted is very evenly distributed. This indicates that the errors were not of a tricky nature, and that careful observation would have made the contestant aware of the nature of the scientific mistakes.

Another fact which should be borne in mind is that of the more than 7,000 entries in this contest, not one of the contestants received a rating higher than 70%. Whether this indicates that the reader need brush up on his powers of observation or whether it necessitates an increased familiarity with science is something which we cannot judge. In view of the fact that all of the scientific errors were located practically an even number of times, we believe that the fault rests primarily with the observation on the part of the contestant and with his study of the subject.

The Correct Answers

HERE is a list of the correct answers as originally planned. Compare this list with the errors you located, and find how many errors you missed.

1. Leo on the sun dial has the wrong symbol.
2. Virgo on the sun dial has the wrong symbol.
3. The signs of the zodiac are arranged in wrong order.
4. The angles of gnomon are all wrong, as neither of the sloping edges points to the North Pole to form an approximate 40-degree angle with horizon, which is correct, assuming that the dial is located in the vicinity of New York.
5. The gnomon points in the wrong direction, judging by the setting sun.
6. Numerals on the dial are in the wrong position, as number XII should be directly north of the center of the dial.
7. There should be numerals on the dial for all the hours between 5 A. M. and 7 P. M. (15 numerals), assuming, of course, that the dial is in use at latitudes approximately the same as the latitude of New York.
8. Numerals on the dial should be arranged in clockwise order.
9. The shadow of the gnomon and many other objects have incorrect shadows, i.e., cast in wrong direction, too short, etc.
10. The fountain and other opaque objects are shown not casting shadows.
11. The dog is shown walking incorrectly as his left front paw is extended forward at the same time that his left rear leg is extended backwards.
12. The girl in foreground is shown walking incorrectly, as her left hand and left foot are thrown back at the same time.
13. The flag and the skirt of the girl near the wall are waving into the wind, whose direction is indicated by the pennant, the lady's scarf and the arrow of the weather vane.
14. The sun should reflect in the water, as water and air have different optical densities.
15. The untied halyard is dangling in a stiff breeze, which

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Science Cover Contest

Ties Increase $500.00 Awards Originally Posted

is wrong, as wind has sufficient force to cause a noticeable displacement.

16. The diamond design is shown perfectly flat while the rest of the flat is ruffled by the breeze.

17. The flag has no return cord.

18. The cardinal point N is in the position where W should be, as judged by position of setting sun.

19. The cardinal points are arranged in wrong relation to each other.

20. The automobile is shown with the exhaust discharged from front of it.

21. The antennæ wires are shown without any sag, which gravity always produces in suspensions of any type.

22. The lightning is shown with regular sharp angled zigzags which never occur in lightning.

23. The moon is illuminated on the wrong side, and has wrong position relative to sun.

24. The rainbow and sun are shown in the same direction.

25. The colors of the rainbow are reversed.

26. A rainbow could not obscure part of the dirigible as shown.

27. The curve of the rainbow is not a true arc, and is laterally displaced from natural position.

28. A rainbow does not terminate abruptly as illustrated.

29. The dirigible should show at least one power gondola, if it is the Los Angeles.

30. The insignia shown on the fins is incorrect, as the Los Angeles has no insignia on its fins.

31. The ship has no mainstay.

32. The jib and fly jib are reversed, and one jib overlaps the other.

33. Some of the sail ropes are missing.

34. The sign post is planted so that very few can see it, and across the pathway.

35. The sign points south judging from the setting sun, although the legend states that New York is west.

36. New York lies 95 miles west of some coast, according to the sign, which is not true.

37. The shape of the fountain streams does not show any effect of the breeze.

38. A single jet of water cannot split into separate jets as illustrated.

39. The lower streams form perfect arcs and straight portions, instead of a ballistic curve.

40. The streams cannot be broken as shown in the background, nor can they be solid as shown in the foreground.

41. All except one of the streams are producing a ripple. The formation of a series of simple ring ripples is impossible, due to the destructive interference of the adjacent and reflected waves.

42. Upper fountain streams appear to vanish in mid-air, heat necessary to produce this effect not available at ordinary fountains.

43. Cigar smoke of the man at the left of the fountain is rising vertically in spite of the breeze.

44. While there is an automobile in the background, there is no drive of any sort for this automobile.

45. Upper fountain jets disappear before reaching the bowl.

46. Waves do not adopt a curve conforming to the curve of the beach on which they break, as shown.

47. The waves are shown not parallel to those near the beach.

48. Sun cannot appear to set in ocean when viewed from vicinity of New York.

Awards in $500.00 Prize Contest

FIRST PRIZE—$100.00
Herman Grissler, Brooklyn, N. Y.

SECOND PRIZE—$50.00
Madeline Koch, Middlevillage, L. I.

THIRD PRIZE—$35.00
L. Arthur Kenworthy, Brooklyn, N. Y.

FOURTH PRIZE—$20.00
Herbert Scafati, Brooklyn, N. Y.

FIFTH PRIZE—$15.00
Robert Zilliox, Brooklyn, N. Y.

SIXTH PRIZES—$10.00 Each
Gustave Gettenberg, New York, N. Y.
Henry Peters, Queens Village, L. I.
Victor George Ploen, Brooklyn, N. Y.
Henry Windhorst, Brooklyn, N. Y.
Fred Weber, Brooklyn, N. Y.
V. A. Royter, Brooklyn, N. Y.
John Consigli, Brooklyn, N. Y.
Michael Meoli, Brooklyn, N. Y.

20 SEVENTH PRIZES—$5.00 Each
H. Hoffman, Hawthorne, N. J.
Roland A. Wright, Maywood, Ill.
Lester E. Keene, Newtonville, Mass.
R. E. Melling, San Pedro, Calif.
I. Liben, New York City.
Peter Strickler, Sheridan, Penna.
Kenneth C. Clark, Seattle, Wash.
Millie Hefner, Bethany, Mo.
Alton A. Parsons,
Huntington Park, Calif.
David H. Lawrie, Talara, Peru, U.S.A.
John H. Bonbright, Detroit, Mich.
T. J. Coalmann, Huger, Ore.
H. A. Fanckboner, Chicago, Ill.
Fred D. Ayres, Gainesville, Fla.
L. Anciaux, Montreal, Can.
W. P. Graham, Syracuse, N. Y.
Arthur B. Kinney, Lima, Ohio.
L. W. Champion, Quebec, Canada.
Edward Mahon, Vancouver, B. C.
Ursula Greene, Alberta, Canada.

40 EIGHTH PRIZES—$2.50 Each
W. W. Barkhoff, Kimball, Neb.
Lewis H. Hefner, Kansas City, Mo.
David Hawkins, Lakeville, Conn.
John C. Hecker, New Brighton, Pa.
Robert W. Mott, Portland, Ore.
Paul Irbin, Boston, Mass.
James Corbin, Schenectady, N. Y.
John E. Dubravac, Portland, Ore.
Albert R. Soliss, Pearl Harbor, T. H.
Marie F. Deamer, Jenkintown, Pa.
R. F. Emerson, Schenectady, N. Y.
Fred M. Holl, Bucyrus, O.
?—From 127 38th St.,
Newport Beach, Calif.,
(no name on letter)
R. Shaffer, Colorado Springs, Colo.
Sidney J. Marshall, Washington, D. C.
Joseph P. Dean, Seattle, Wash.
Charles A. Wolff, San Francisco, Calif.
Graham Stuckey, Alexandria, La.
Leonard S. Patterson,
Hollywood, Calif.
Leo T. Eckstein, Beaverton, Ore.
H. W. Dunlap, Richmond, Calif.
F. M. Drial, Marshfield, Ore.
Kenneth Krausche, Roselle Park, N.J.
Gene Middleton, Salt Lake City, Utah.
Art Reall, Hollywood, Calif.
S.S. Schinneer, Williamsville, Ill.
G. S. Scott, Timmins, Ont.
Robert Edgerton,
Rocky Mountain, N. C.
Robert Conrad Putnam, Atlantic, Mass.
Dr. Louis H. Roddis,
Washington, D. C.
Dr. G. Theodor Fischer,
Brooklyn, N. Y.
Mrs. W. R. Dawson, Coraopolis, Pa.
H. Austin, Vancouver, B. C.
Samuel James Shaffer,
East Boston, Mass.
John H. Driscon, Apia, Samoa
J. L. Porter, Blacksburg, Va.
Arne Engberg, Kearney, Neb.
John D. Shishkin, Picayune, Miss.
Lee Tee Schnur, Cleveland, Ohio

Tying for the 40th Award in this group; hence, identical prizes will be paid each, are:
Leroy Osborne, Los Angeles, Calif.
Wilbert Amster, Sparing City, Pa.
Theodore Golder, Los Angeles, Calif.
Rudolph Raspet, Export, Pa.
Emory Hedge, Ladoga, Ind.
D. P. McCallum, Vancouver, B. C.
John Stevenson, Chicago, Ill.
Edward Brandt, Chicago, Ill.
H. J. Streater, Saskatchewan, Can.

Frequent Errors

SOME of the most frequent errors found in the answers might be here advantageously listed. For example, many of the contestants stated that "the lightning is coming out of a clear sky." Scientifically, it is perfectly possible to have lightning come out of a cloudless sky.

Many contestants mentioned the "water line" on a ship as an error, stating that the ship is listing in a direction which should hide the water line. This cannot be construed as a scientific error because the vessel, in being painted, may have had the "water line" put purposely 6 inches above the required level. The position of the bearing point of the arrow on the weather vane was another supposed error, frequently pointed out; but it is conceivable that one side of the arrow could be a little heavier than the other. Many looked upon the color representations as being of vast import in spite of the fact that the contest rules discounted these.

16 More Pages in This Issue

You will have probably noted that the physical make-up of this magazine has been changed with this issue. The number of pages has been increased, the type changed to be more easily read, and the paper is of better quality.

We aim to be first always in presenting accurate, scientific information, and we succeed.

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HOME MOVIES

"HELLO, Mr. Jones," George Blake was speaking as he approached the movie counter of Rockland's camera shop. The man he addressed was straightening up his stock

Above is a reproduction of a movie title or caption which is an example of artistic work.—Courtesy Stanley Educational Film Division.

after a busy period, but left his work to join his customer.

"I have a full four hundred-foot roll finished and I thought I'd take up that title offer. You know you promised to tell me something about making titles."

"That's right, Mr. Blake, and fortunately I won't be busy for awhile now and we can discuss it thoroughly. Titles, you know, are a subject in themselves, in fact, there are many laboratories devoted exclusively to title-making. I know you are interested in making your own titles all the way through, but I would say that the simplest way is to use one of these title boards with movable celluloid letters. All that is necessary is to set up your title with these letters and shoot with the same film you use for taking your scenes.

"A cheaper way is to make your own cards and photograph them on positive stock. The positive stock is 75 per cent cheaper than the reversal film, and you can finish it yourself, thus getting all the fun possible out of your hobby. The cards should be white, with black letters, because when this is photographed and developed, the colors will be reversed so that you will have white letters on a black screen.

Setting Up Titles in Type

"THE letters may be made by hand, using india ink and a brush or pen. If you are not an adept at lettering, it is best to use the type method the same as the professionals use. You can use as many type faces as you want, this card shows but a few (see Fig. 1). The *pastel* is probably the best looking type, but it does not have the clear lines of the *parsons*. Parsons is used for most motion picture titles because it has beauty, is easily read and distinctive. A title should be easy to read, you know. If your audience must struggle with a title, they lose interest in the picture.

"After you have decided on the type faces you want to use, you should get a font of capitals and two fonts of lower case letters. This will be sufficient to set up several titles at a time. This assortment will cost about eight dollars. Then you must get a font of spaces and quads for spacing out the letters and words. This will cost about a dollar. Parsons is a little more expensive than the others and will cost about eleven dollars for the assortment. Get all these in 24-point size. That is the printer's measure, and signifies type about one-third of an inch in height.

This is Gothic, the model to use when hand-lettering your titles.

THE good old Caslon Black is a good title face, especially when used with a display initial, as in this case.

Fig. 1, above, shows at A a sample of Gothic type, and at B, Caslon black.

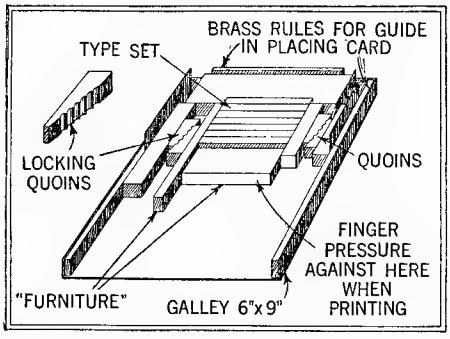

Fig. 2. The above illustration shows a galley, with type set for making the titles.

"For holding the type while printing you will also need a galley and furniture. The galley is a brass tray that has a perfectly flat bottom and straight sides. The type is put in this and held tightly in place with the furniture, which is nothing more than blocks of hard wood cut exactly to specified sizes. To line the cards up so that they will be printed straight, we put three strips of brass rule around the type, between the furniture and the galley walls. As we use cards measuring five by six inches, you will see that the cards will just fit into the rules and be held in line while the impression is made (Fig. 2).

Substitute for Printing Press

"A PRINTING PRESS would cost too much for any amateur to use in making titles, so we must find a substitute. Get an old letter press from a junk shop or second-hand store (Fig. 3). This can be converted into a press that will suffice for our purpose. You will find that the upper platen is curved inward from the edges, and as we must have an absolutely flat surface it is necessary to bolt on a piece of one-eighth inch iron. To this glue a piece of one-quarter inch felt, this serving to equalize the pressure and distribute it evenly over the card.

"You set the type so that each line is four inches long. Each line must extend from one side to the other, any difference being made up by inserting thin spaces between words in the line. The initial letter may be omitted and a hand-lettered capital drawn in or a display initial used. Purchase a hundred white cards, eight-ply stock, and fifty of the same weight in a light tint mottled surface. When you have your title set up, put it in the galley and center it longitudinally. Put a thin strip of furniture on each side of the type and another piece opposite it on the galley wall. Insert a quoin between the two. Now take one of your cards and place it over the type. Mark on the sides of the galley how far down it comes. Then shift your type so that it is centered between these two marks. Put furniture in at the top of the galley to fill up the space, and fill the remainder at the bottom of the galley with furniture.

Inking the Type

INK the type with black printer's ink and lay the card over the type, using the brass rules as a guide. Slide the galley into the letter press, and holding the press with one hand, turn the wheel until the platen forces the card against the type. Of course you must push against the furniture at the open end of the galley while pressing, so that the type will be held firmly against any side movement. Similarly, the quoins which you placed at the sides of the type should be tightened before inking.

Title Illuminator and Holder

"YOU now have your card. The next job is to provide a means of photographing it. Your regular movie camera does this job to perfection. All that is necessary is to have an easel to hold the card and a support for the camera. Illumination of course must be provided. The outfit shown in this sketch (Fig. 4) will give you not only a title board for

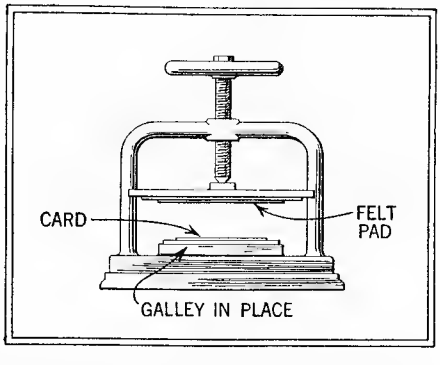

Fig. 3. An old letter press can be converted and used as a substitute printing press.

your regular titles but will also provide means for animated and trick work. It is easy to construct, and inexpensive. The easel itself is a 22 x 28 inch draw-

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How to Make Titles for the Amateur Film At Home

Conducted By

DON BENNETT

Motion Picture Expert

ing board. This is hinged on its longer edge to a T that holds the camera and light supports. The T is made of ¾- or ⅞-inch pine. Down its center it has a ¼-inch slot that serves as a guide for the camera support. The camera support is made of ⅝-inch wood, is four-sided, and the inner corners are braced with quarter-round molding. In the bottom are drilled two ¼-inch holes which take ¼-inch bolts and wing nuts for fastening the camera rigidly to the T. The long slot in the base allows the camera to slide back and forth, including more or less field of vision as the case may be. The light support is a piece of wood twelve inches long and three inches wide. At either end of this is erected an upright two and a half or three inches square. On the top of each upright is fastened a socket and reflector. The reflector is fashioned from tin seven inches long and six inches high. This sketch shows clearly how this is shaped. The back is painted black so that there will be no reflections into the lens. In these reflectors are placed two 200-watt lamps, one in each, and they are wired together with a switch and extension cord for attaching to the house line.

How to Use Title Board

"AFTER our title board is completed, we must set and focus the camera. The lens is on a center with the center of the title outfit and that requires no adjustment, except for pointing the camera correctly. The focussing is a little more difficult. With the five by six card we are using the camera is placed so that the lens is thirteen inches from the title card. This is closer than most lenses will focus, so we must compensate for the difference. The method of compensation varies with the camera you are using. With the Cine-Kodak, you purchase a sixteen-inch portrait attachment and slip it over the lens. With the Filmo and Victor, when using a fixed focus lens, it is necessary to unscrew the lens so that it will focus sharply on the card. By referring to a focussing graph we see that for thirteen inches we must unscrew the lens two and three-quarter turns. This focusses sharply, but to make certain stop your lens down to f 4.5 and run camera at regular speed. If you have a lens that focusses to say, three feet, consult the chart again. For three feet (along the top) we see that about seven-eighths of a turn is necessary. Subtracting this from two and three-quarters leaves one and seven-eighths, or almost two complete turns *additional*, when the lens focussing mark is set at three feet. Follow the same plan if your lens focusses to two feet. In this case one and three-eighths turns are made.

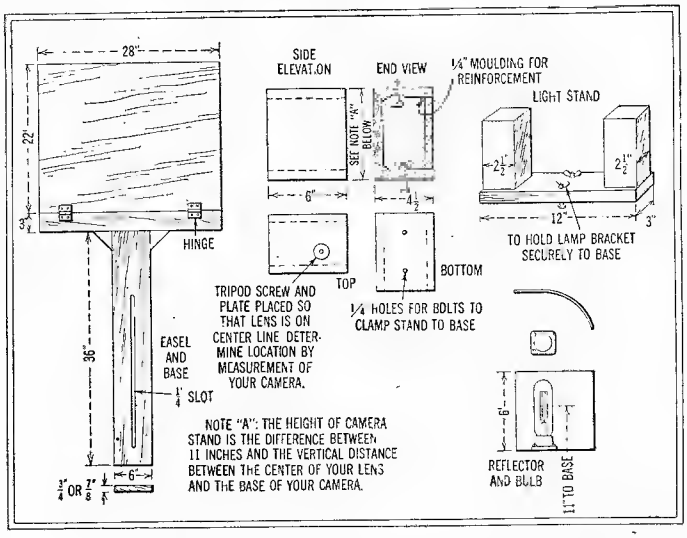


Fig. 4. The above illustration gives the necessary constructional details for the title holder and illuminator.

"When your lens is set, put the lamps in position about ten inches away from the title board, put the card in place with glass-headed push pins, turn on the lights and, having your camera loaded with positive film, shoot. You allow one second for each word in the title, however, never use less than two feet. For example: *"We arrive at Lakeland with a promise of perfect weather for our vacation."* That sentence contains thirteen words, or thirteen seconds of film, which, disregarding fractions, is five feet. Run off that much film and you are ready for the next title."

"But, Mr. Jones, if I use positive film how am I to get it developed?"

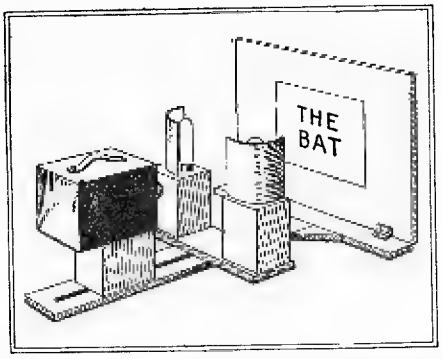
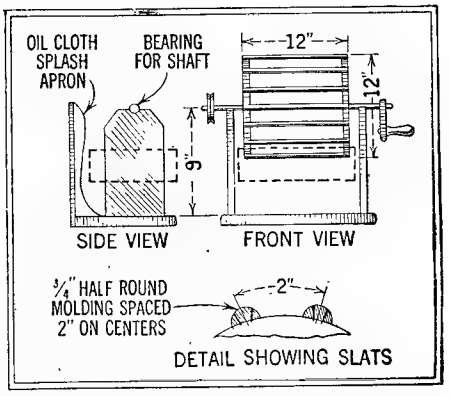


Fig. 5. The title illuminator and holder is used as illustrated above. It is adjustable.

Constructing a Simple Title Holder and Illuminator



Home-made rotary frame for developing films is shown above. A pan to hold a solution is shown in dotted line. Fig. 6.

Developing Title Film

"YOU can send it to a laboratory, but it is much more fun to do it yourself. All that is necessary is a drum developer (Fig. 6) and a few chemicals. The film is removed from the camera and wound on the drum in the darkroom under a ruby lamp. You can use either the famous No. 16 formula, which can be purchased ready for mixing, or you can mix it from this formula.

No. 16 Developer Formula

Water	½ gallon
Metol	9 grains
Sodium sulphite	1¼ ounces
Hydroquinone	176 grains
Sodium carbonate	1¼ grains
Potassium bromide	25 grains
Citric acid	20 grains
Potassium metabisulphate	45 grains

Mix in order named and use full strength

If you prefer a simpler developer that will give more contrast you can use this one:

Contrast Developer for Titles

Water	½ gallon
Elon	5 grains
Sodium sulfite	1¼ ounces
Hydroquinone	193 grains
Sodium carbonate	1¼ ounces
Potassium bromide	25 grains
Potassium metabisulphate	20 grains

"This developer will give you good contrast in your titles and at the same time the blacks will be soft and dense. Take a short piece of exposed film and put it in the developing tray, agitating it slightly. It will develop in from three to six minutes. Time this carefully, and when you have determined the proper density put your drum of film into the developer and let a motor rotate the drum slowly. You should turn out the red light for the first half of the indicated time and then watch the film closely as the time limit expires. The rotation of the drum may cause the film to develop at a faster rate than the sample. The eye test is the safest. When the film has developed sufficiently, remove the developer tray and put one containing 5 per cent of acetic acid in water in its place. A few minutes in this and a tray containing the fixing bath should (Continued on page 779)

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EXPERIMENTAL

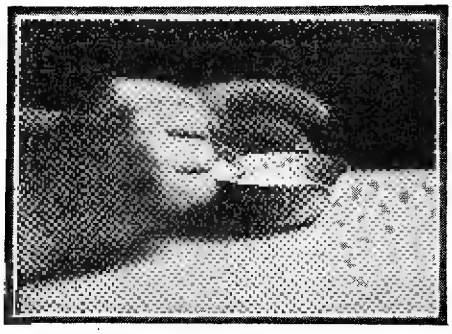
CHEMISTRY and ELECTRICS

Cements and Glues

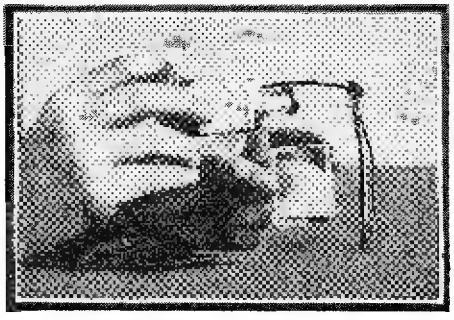
Instruments for Mixing Easily Made Waterproof Cements and Glues

By
DR. ERNEST BADE

WATERPROOF glues and cements are very hard to find and when a cementing material is found which will possess good adherence and be waterproof, acting as cement or as even underwater glue, it is of special value. Such a cement or glue can be made for a few cents by anyone, as no particular apparatus is required for its preparation. All that is needed is a glass beaker or porcelain vessel which may be heated. Into this vessel pour enough creosote to fill the bottom of the container to a depth of about one-eighth of an inch. Heat this liquid over a very small flame to just below ebullition. Then slowly and gradually drop in flake shellac until a considerable quantity has been added. Enough should be used so that the liquid, while it is still hot, is stringy and slightly syrupy. Cool, and when cold try its hardness by pressing the finger nail into the mixture. If an impression of the nail can be easily obtined, reheat the substance and add more shellac. The consistency of the mixture when cold should be such that the finger nail will only leave an almost imperceptible impression. When in this condition, the cement is ready to use.



A waterproof cement consists of litharge and glycerine. The mixture must be stirred until no lumps remain, and the cement must be used within a half hour, otherwise it will harden.



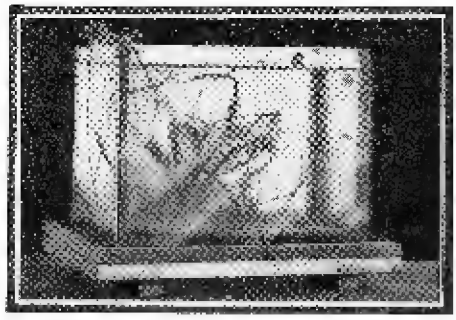
Into a beaker pour enough creosote to fill the bottom to a depth of about one-eighth of an inch. Heat and slowly add flake shellac.

Enough of the shellac should be used so that the liquid is stringy and slightly syrupy while still hot. It should be tested with the finger nail when cool.

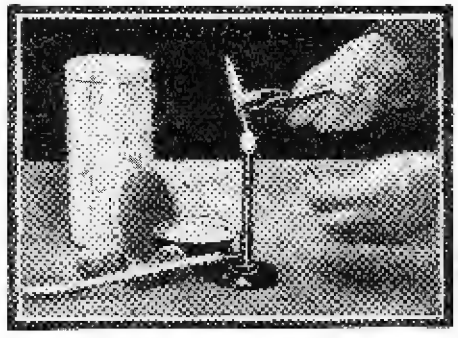
How to Make Various Kinds of Adhesives for Joining Wood, Metal and Crockery.

This hard cement is especially valuable for mending porcelain or cementing together two or more pieces of glass. Then, too, it can be used to cement glass or metal to wood or to leather. In fact, it may be used to unite metals or any similar or dissimilar substances, such as fastening handles on tools, etc. This cement is absolutely waterproof, water having no effect on it over long periods; alcohol, acetone or alkalies dissolve the cement.

In order to use the cement, the parts to be united must be carefully heated over a small flame until they attain a temperature sufficiently high to make the cement flow easily. First heat the cement, then heat the parts to be united, smear a very small quantity of the hot cement over the hot parts to be fastened together and press until cool. It will then be found that the parts cemented together are very firmly united and will not come apart.



This shows an aquarium that was built, using the waterproof cement specified here.



Setting knife blades in handles is best accomplished by heating rosin, adding half the quantity of powdered chalk, and pouring the heated mixture into the wooden handle. The tong of the knife is quickly heated and inserted into the handle while rosin is soft.

Waterproof Cement for Wood

FOR a waterproof cement used to unite wood or paper or a combination of wood, paper or cardboard, a softer mixture may be used, and this is obtained either by using less shellac or by adding more creosote to the hard cement. For such use a consistency is required which will allow an impression to be made quite easily in the cold mixture. But for porcelain, metals or glass the harder mixture is a necessity. It also must be remembered that in order to unite substances with this cement, the cement and the objects to be united must be heated to such a temperature as to make the cement liquid. Only under such conditions will the joint be perfect.

The addition of potassium bichromate to carpenter's glue in order to make it waterproof, usually falls down for the simple reason that it must be exposed to sunlight in order to make it insoluble. This condition is rarely met, for the glue, when placed in wooden joints, is in total darkness. Since light cannot enter, the joint is just as weak as if ordinary glue was used. Formaldehyde is sometimes used to make it waterproof.

In preparing carpenter's glue, (*Continued on page* 761)

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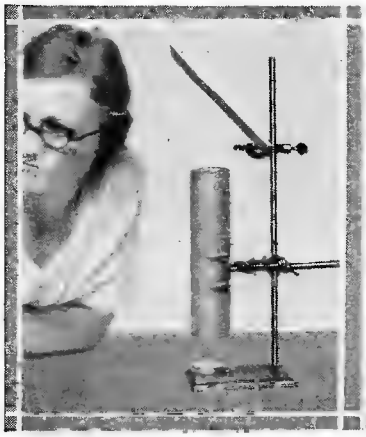
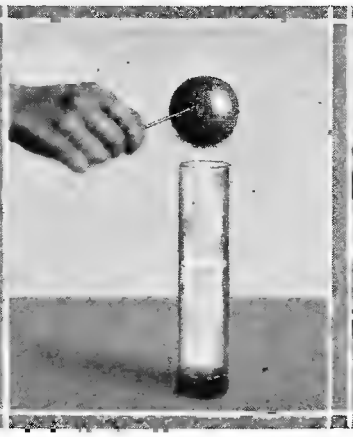
Scientific Fun With Little Or No Apparatus.



Listening to a watch in the manner shown above will show that sound waves can be reflected. A smooth, hard reflector works best.

Two bodies cannot occupy the same position at the same time. When a nail is tapped the displaced water breaks the flask.



When the bell is held at the right distance above the water level, the air column is adjusted to resonance and a strong note is produced.

A "musical flame" may be obtained by burning a jet of gas from a medicine dropper, held in the lower end of an iron pipe.

Simple Scientific Experiments

By RAYMOND B. WAILES

Eight experiments which can be duplicated by anyone are picturized here

AN old parlor trick is that of melting lead on a visiting card which has been formed into a tray. A new version is boiling water in a paper cup. This really can be performed, for as fast as heat can be applied to a paper cup containing water, the heat in turn is imparted to the water, which soon boils. As boiling water cannot cause paper to take fire, the cup will not burn, for it will never get much hotter than boiling water.

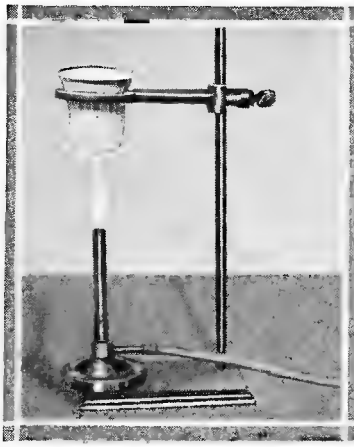
We know that light can be reflected, and from hearing echos we can easily deduce that sound can be reflected. A watch placed at one end of a cardboard tube having a deflecting card set at an agle at the other end will reflect with marked clearness the sound waves to the experimenter.

Sound can also be refracted, or bent, and "focused" in exact accordance with the same action in the case of lights. A watch held at an easily determined distance from a toy balloon filled with carbon dioxide gas can be distinctly heard by the experimenter, if his ear is placed the same distance from the balloon on the other side.

"Bodies at rest tend to remain at rest" is an old school-time axiom. A card placed over the mouth of a tumbler and supporting a silver quarter can be flicked with the forefinger so that it will be driven across the room, while the silver quarter will drop down into the tumbler.

The principle of the water lift pump can be seen using two medicine, or eye droppers. With the rubber bulbs removed, fasten the two tubes together with wire, at right angles to each other as shown in the photo. With the tip of the horizontal tube over the tip of the upright tube, blow through the horizontal tube, this will cause the water in the upright tube to be drawn up through the tube and sprayed out or atomized with the air which is being blown through the horizontal tube. Water can be removed from excavations by applying a modified form of this principle.

"Two bodies cannot occupy the same space at the same time," is another well known adage of physics. Fill a bottle with water and pass a 20 penny nail about half an inch through the cork of the bottle. If the nail is struck with a hammer, it will be forced inward, and as the water within is not compressible in the ordinary sense of the word, the bottle will be broken to pieces by the pressure. A chemical flask or thin walled bottle serves very well for this experiment. The cork should fit the bottle well and there should be no air (*Continued on page 779*)



Water can be boiled in a paper cup without burning the paper, by simply filling the cup with water and heating it as shown over a flame.

Sound waves can be refracted, and this can be shown experimentally, by using a toy balloon as a refractor. Locate the focus by ear.

Bodies at rest resist acceleration. The card may be moved away from under the coin by a flick of the finger. The coin will drop into the glass.

Two medicine droppers may be used as shown to demonstrate the operating principle of atomizers, certain lift pumps, and boiler injectors.

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THE CONSTRUCTOR

Making a Small Lathe

Small Motor and Toy Building Set Used in the Construction

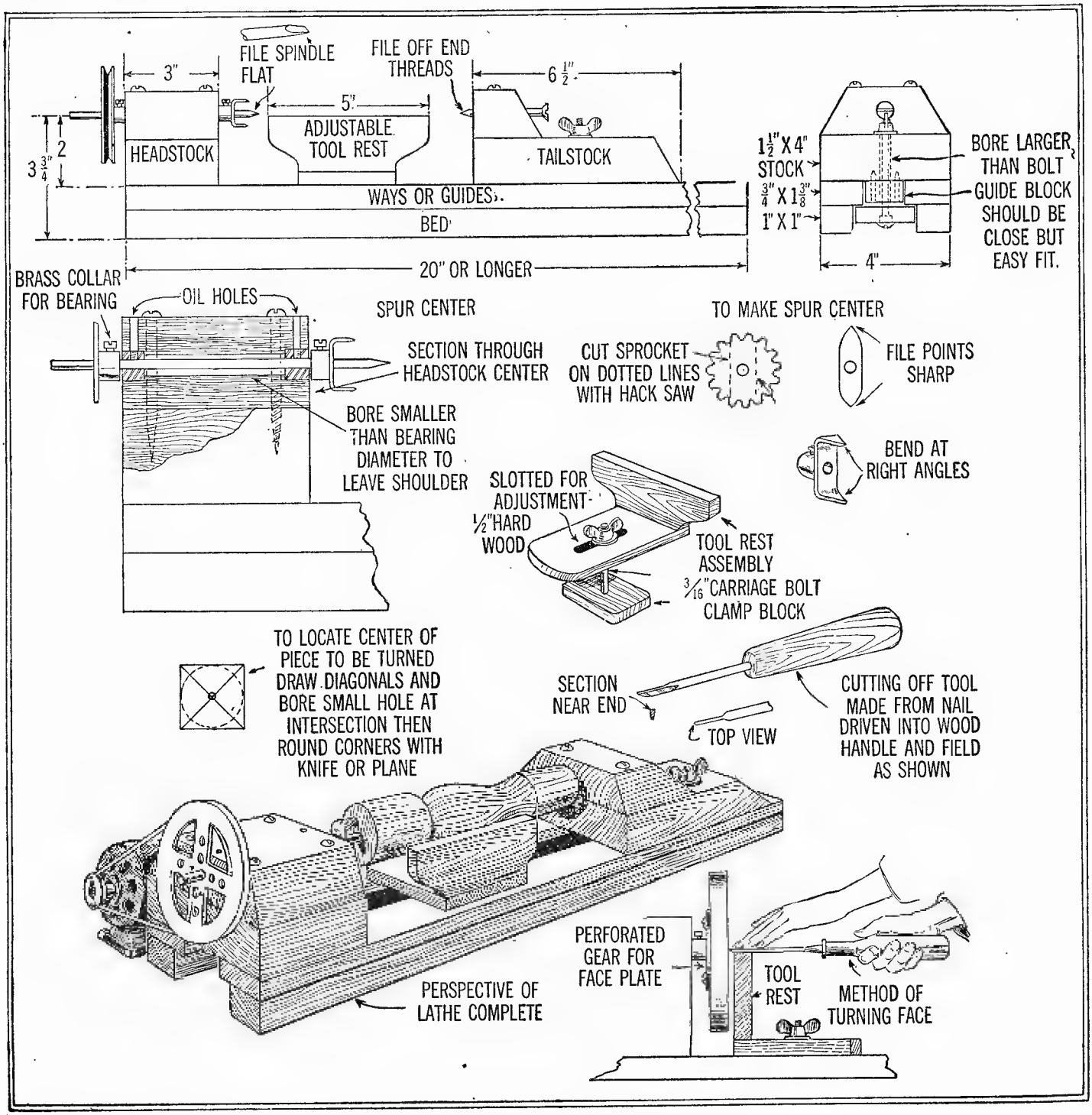
By HI SIBLEY

The drawing below gives the complete details for the toy lathe. Model parts can be turned out easily on this machine.

LONG before he is able to afford a bench lathe or have access to those in the school manual training class, the mechanically inclined boy can easily make his own. The principal requirements are a small motor and parts from a standard toy construction set.

The original of the design shown here was made in one morning to amuse a young convalescent, and its performance was so satisfactory as to surprise both maker and the patient.

Of course, this is by no means a production lathe—not a machine on which you can turn out chair legs in quantity, but it is very handy for small items, such as capstans, spindles, etc., for model ships; grooved pulleys and numberless things which can be (*Continued on page* 760)



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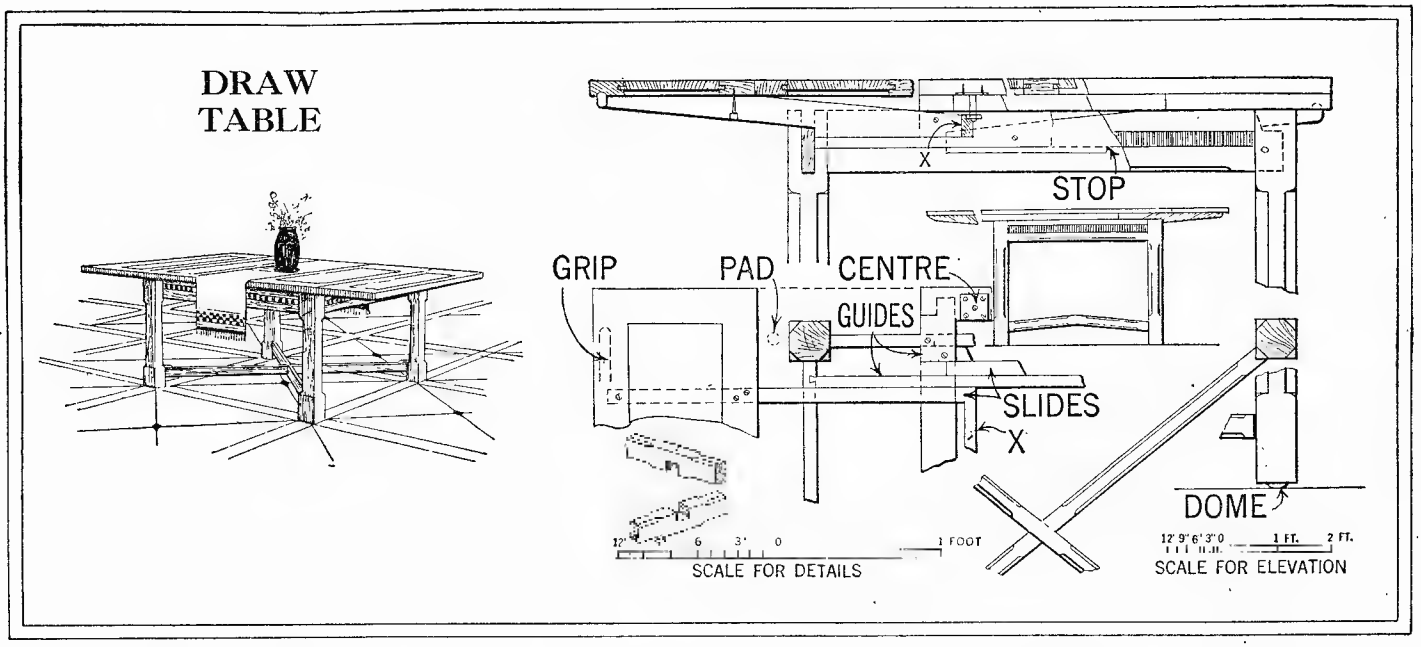


How to Build a Buffet of Modern Design at home for Reasonable Sum

A *Modern* Sideboard

A MODERN sideboard or buffet can be built easily by the home constructor. The overall height is 3 ft. and it is fitted with two drawers and two cupboards. The top boards should be carefully matched and the grooves for the tongue should be stopped about 1 in. from each end. A mild mahogany is suitable for the interior, although cedar can be used. The construction can be simplified by using 5/8 in. plywood for the back, bottom and divisions, and 3/8 in. for drawer bottoms. The drawers are dovetailed together and a dust board provided as indicated. The top should be buttoned to the top frame and the riser secured by screws. Most other joints can be mortised and tenoned.

Increased accommodation can be obtained by the addition of another drawer in the central portion, making the height 3 ft. 3 in. instead of 3 ft., and reducing the length of the legs in proportion. In this case the diagonal underframing should be straight.—*J. E. Lovett.*

The completed buffet is shown in the illustration below. Constructional details will also be found. The design is representative of the modern style.

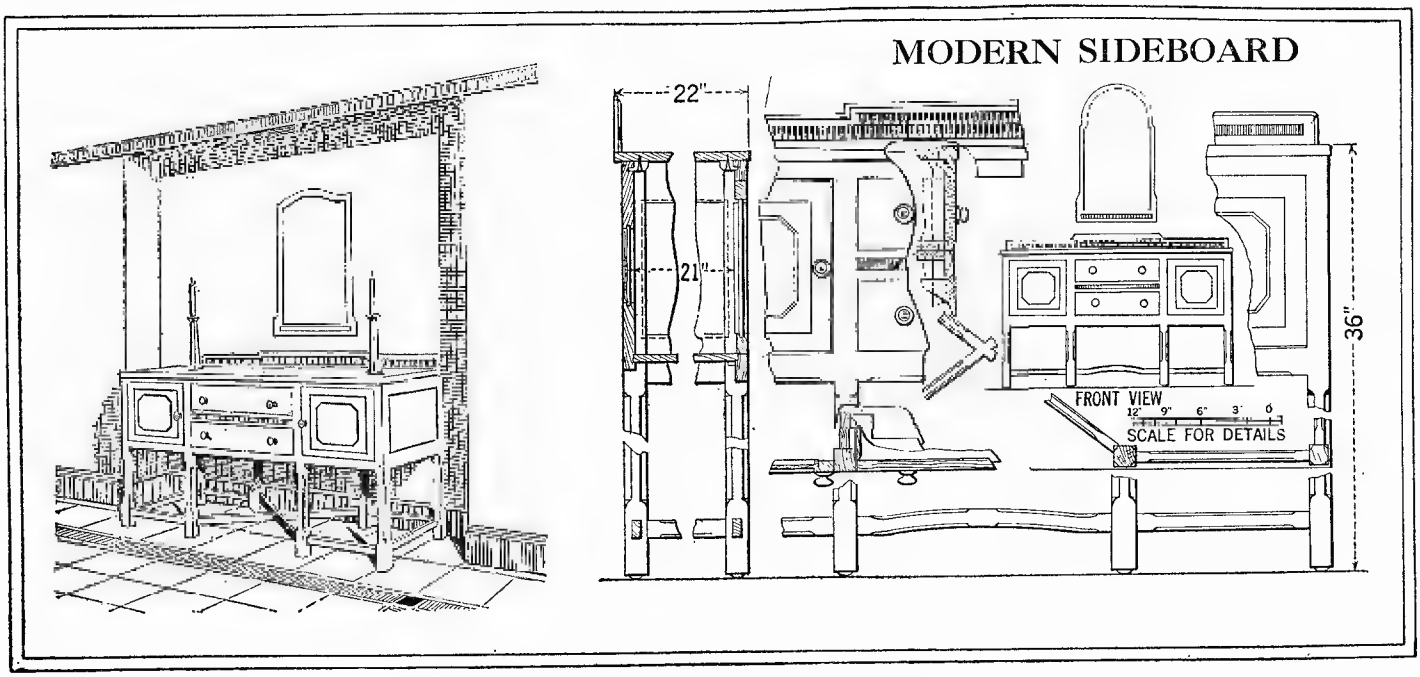
Construction of a Dining Table of Useful Type Described Here

A *Simple* Draw Table

THE table illustrated here is an example of modern cottage furniture. To reduce the possibility of warping, the top should be framed properly. The small panels should be carefully matched and finished with a small chamfer to break the joint. Card table centers are secured under the central portion, passing through the frame as indicated. The middle leaf is thus kept in position. The main joints should be properly framed together with mortise and tenon and can be strengthened by pins. To prevent the underside of the center leaf from scratching the top of the end leaves, a padded felt is secured at each corner. The inner pair of sliders are kept parallel by a cross rail dovetailed into their ends and the outer pair by a guide and a guide rail dovetailed into the end rails.

The diagonal underframing rails can be shaped as indicated and are not likely to be used as a footrest.—*J. E. Lovett.*

At the top of the page is an illustration giving constructional data for the "draw" table. A view of the finished table also appears in the illustration.



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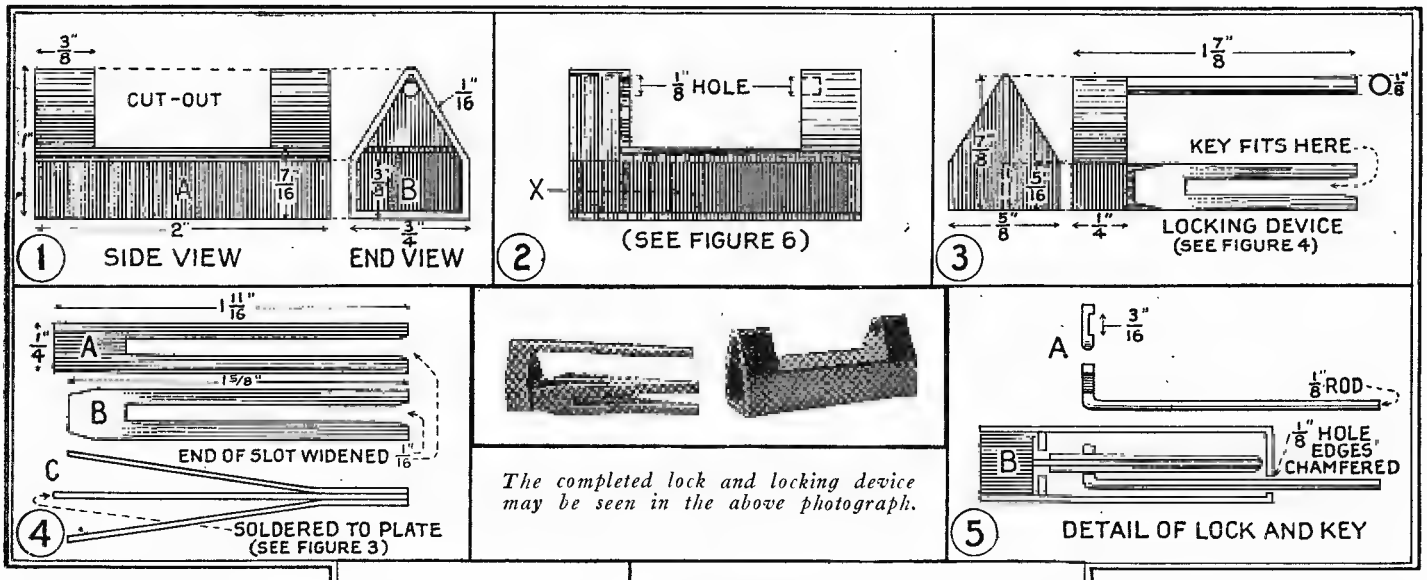
HOW *to* MAKE *IT*

An Ornamental *Lock*



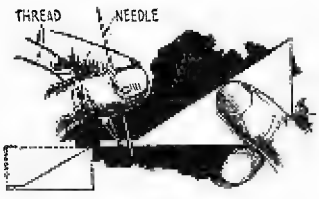
A very novel design for an ornamental lock is shown here. The body of the lock is made of brass 3/4 in. in thickness, as indicated in Figs. 1 and 2. The construction of the rest of the lock is shown in Fig. 3 and the locking device in Fig. 4. This is soldered to the end plate.

The completed lock and locking device may be seen in the above photograph.

Fig. 5 gives the details of the lock and key. The key is simple and when pushed in acts upon the two springs, releasing the lock. The dimensions given provide for a tight fit and accurate machining. A view of the completed lock resembling a miniature tool chest, is shown in Fig. 7.

A NOVEL padlock made in the form of a miniature tool chest can be constructed as illustrated. The body is made of brass and is filed into the shape shown in Fig. 1. With a drill and sharp file, the block is hollowed as illustrated in Figs. 1 and 2. The construction of the rest of the lock is shown in Fig. 3. The locking device is shown in Fig. 4 and consists of a piece of 1/16 in. brass strip fashioned as shown in A, and two similar strips 1/16 in. shorter. These are bent and soldered together as shown at C. The locking device is soldered to the end plate as in Fig. 3. A small piece is cut as shown in Fig. 5 and soldered into position marked X in Fig. 2. Fig. 5 gives the details of the key. A small hole must be bored in the end of the key in order to admit a piece of 1/8 in. rod bent and filed as shown in Fig. 5, so that the slot will engage the corresponding slot of the springs.—*D. H. Menzel.*

Needle Threader



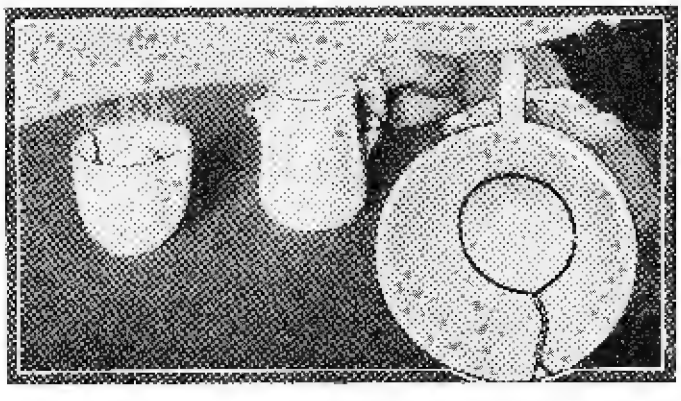
A sewing needle can be easily threaded by utilizing the device illustrated above. A piece of tin is used for the threader.

A HANDY needle threader can be made from a piece of tin about 2 in. long and an inch wide, cut to the shape shown in the illustration. The narrow portion is notched and holds the thread which is easily pulled through the eye. The point of the threader should be small.

—*S. Leonard Bastin.*

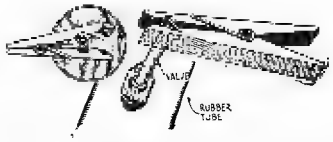
Egg Boiling Kink

WHEN boiling one egg instead of using a large pot, the simple method shown here can be used to advantage. A holder for the egg is constructed from heavy wire and hooks on the edge of the cup. The egg is placed within the loop and hot water poured into the container. After the egg has been cooked, it is a simple matter to lift it from the cup by using the holder. The construction and placement of the wire eggholder may be seen in the photo.—*C. A. Oldroyd.*



The above photograph shows a cup fitted with a wire holder for holding an egg for boiling. Hot water is poured into the cup and quickly boils the egg which is easily lifted.

Valve Depressor



A valve depressor can be made from an ordinary spring clothespin and a wire brad as shown in the above drawing.

A VALVE depressor can be made from a spring clothespin and a brad placed as shown. By removing the dust cap and slipping the pin over the valve stem with head of wire brad down, the valve stem will be depressed. The device is inexpensive yet will find much use in the garage.

—*L. H. Hutchinson.*

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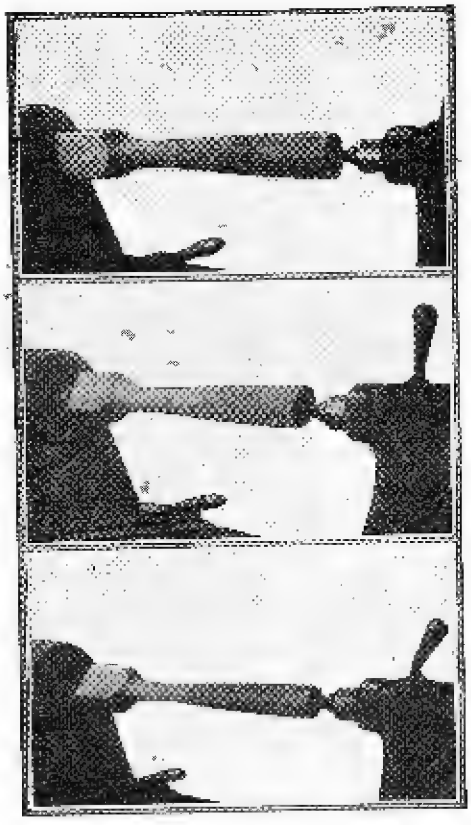
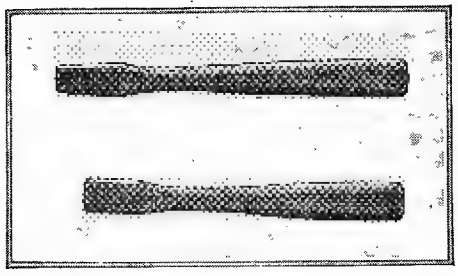


WOOD-TURNING

By H. L. WEATHERBY

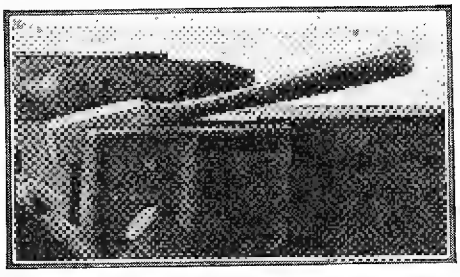
Article Number 6 in a Series

Making Hammer and Hatchet Handles



The above photo shows two types of handles made as described in the text. At the left the work is shown in position in the lathe. A block is placed in the lathe on corresponding off-centers and one side turned with gouge and chisel. At the right is one of the handles placed in a wise for finishing by hand with spoke shave and scraper.

Oval Handles Can Be Turned Out Easily When Once the Method Is Learned. This is the Simplest Sort of Spindle Turning.



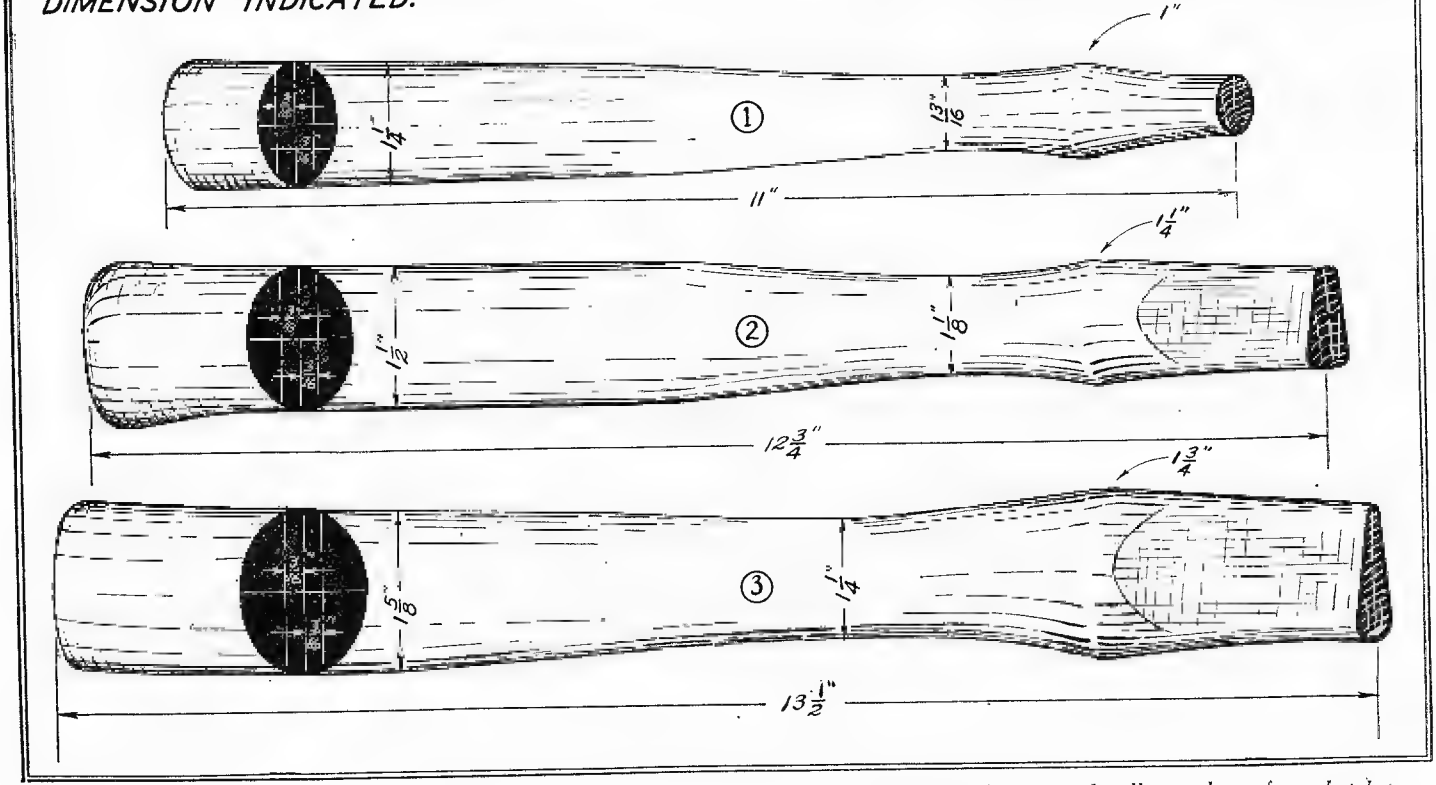
SECTIONS ARE SHOWN IN BLACK, WITH DIMENSIONS FOR CENTERING. THE OFF-CENTERING MAY VARY SLIGHTLY EITHER WAY FROM THE DIMENSION INDICATED.

~OVAL TURNING~ HANDLES

NO. 1-BALL PENE HAMMER

NO. 2-CLAW HAMMER

NO. 3-HATCHET OR HAND-AX



Above—Determining off-centers for oval handles.

Here are two types of hammer handles, and one for a hatchet.

A VERY useful novelty in turning that should not be overlooked by the amateur, who wishes to master the art in its various phases, is that of three center work, or oval turning, as it is erroneously called. The oval produced by this method happens to be an approximate ellipse, rather than an egg shape, but the result (*Continued on page 775*)

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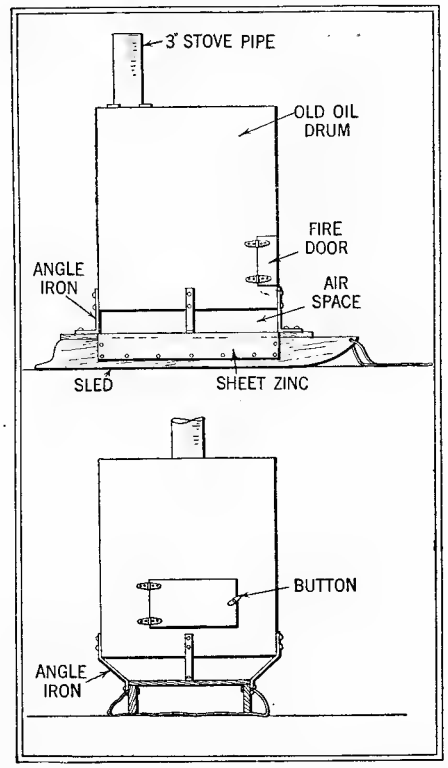
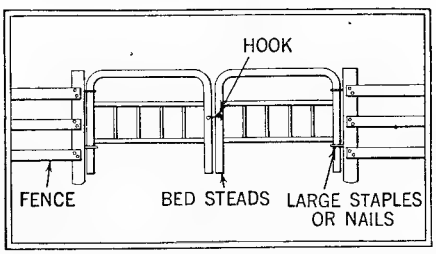
Recipes, Formulas, *and* Wrinkles

Warming Stove



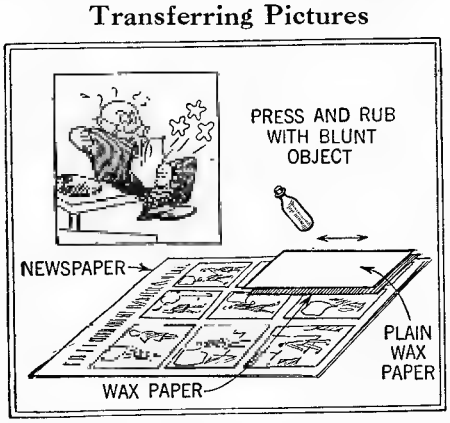
The stove above is to be used with skating parties, and consists of an old sled covered with a sheet of tin. The heater is made from an old oil drum, and a short length of stove pipe is used for the chimney.
L. B. Robbins.

Gate



An old bedstead will make a good gate when fastened to two fence posts as shown above, large staples being used for this purpose. Spikes can also be employed for fastening the metal to the wood.—T. Uleman.

Transferring Pictures



Newspaper prints can be transferred to white paper by using a sheet of wax paper and rubbing evenly over the surface with a blunt object.—A. F. Lonk.

Everyday Hints

Rubbing a tallow candle on the bottom of the wood plane or side of the hand saw will make them work easier and better.

Small squares of rubber cut from old rubber floor mats make good floor protectors when placed under legs of desks, tables or other furniture, especially where the floor is polished. This will prevent scratching of the floor. This can be secured to the legs with liquid glue.

The old style cut iron nails will hold better in brick or cement work than the new style wire nails. They will drive in the brick or cement without bonding.

Old office desks or furniture can be cleaned by using soap and water; rubbing hard until all dirt is removed. After drying use a good furniture polish and polish until surface is free of oil.

Automobile springs can be kept well oiled if a piece of rag or waste saturated with oil is packed between springs and frame on each side of car. Every time springs work up and down, oil will be forced down on the springs.—*Contributed by R. M. Thomas.*

How to Make Varnish Remover

An excellent varnish remover may be made by dissolving cake or paraffin wax, shaved fine, in a gallon of benzol, let stand four or five days, then mix with an equal part of high-proof denatured alcohol.

After varnish has been removed from an object, scrub with steel wool and alcohol and then bleach with saturated solution of oxalic acid in hot water. Wash thoroughly, and dry. Object is then ready to refinish.—*Contributed by Kirk B. Thompson.*

Orange II

Orange II, a commercial cotton dye, is prepared by coupling B-napthol to diazotized sulphanilic acid.

Dissolve a few grams of sulphanilic acid in a sodium carbonate solution. Then add the diazo solute (a cold solution of sodium nitrite in HCl). As soon as B-napthol, a phenol easily purchased at any chemical supply house, is added the brilliant dye is formed.

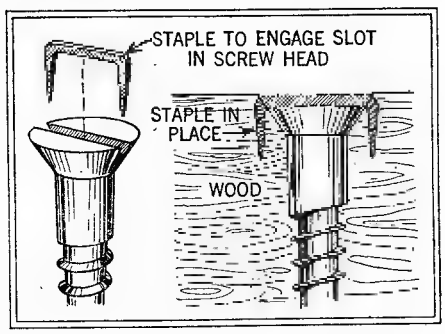
Other phenols and amines yield various other colors.

Sulphanilic Acid

Sulphanilic acid, $C_6H_4NH_2HSO_3$, is of both laboratory and industrial importance, since its diazo derivatives are brilliant dyes, especially for cotton fabrics. It is prepared as follows:

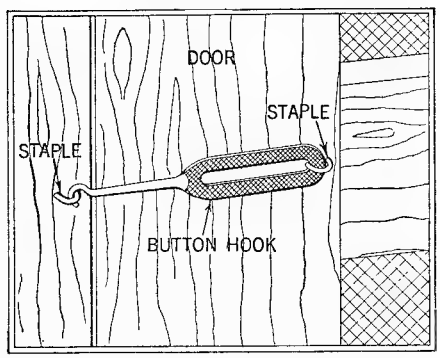
Heat 30 grains of aniline with 100 grams of sulfuric acid until a test portion diluted with water and treated with NaOH yields no aniline oil. When this state has been reached, cool the solution and pour it into cold water. Sulphanilic acid separates out upon standing. The reaction is represented as follows: $C_6H_5NH_2$ plus H_2SO_4 forms $C_6H_4NH_2SO_3$ plus H_2O.

Preventing Screws from Turning



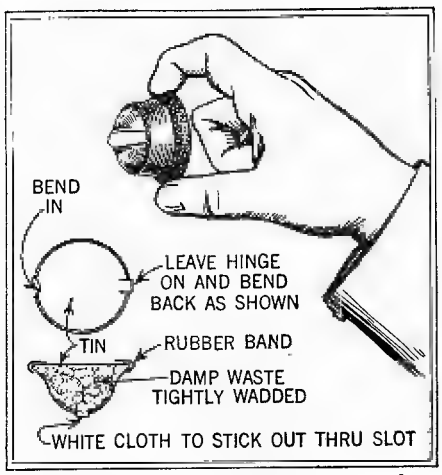
Wood screws may be prevented from turning by following the simple method illustrated above. After the screw is in place, a thin staple is driven over the head so as to engage the slot in the top of the screw. The screw will not turn and can not be removed without first extracting the staple from its position.—J. H. Mote.

Screen Door Hook



A serviceable screen door hook can be made with two staples and a button hook, as shown above. The handle of the hook is fastened to the jamb with a staple, and another staple placed on the door frame so as to engage the hook. If desired, the button hook may be fastened to the door itself and staple on the jamb.—T. Uleman.

Envelope Moistener



A moistener can be made from an old lamp burner. A piece of tin fits the bottom and the slotted portion is covered with a piece of cloth, over which is placed a ball of waste.
—F. W. Bentley, Jr.

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READERS FORUM

Yes, a person can be hypnotized over the telephone and the first time it was ever done via radio was in 1920, by Mr. Dunninger, who spoke over station WHN, then located at Ridgewood, L. I., and hypnotized a subject in the offices of Science and Invention *Magazine, in New York City. A person can be hypnotized over the phone and no doubt by means of a voice on a phonographic record. The subject's imagination is a big factor here.—EDITOR.)*

Egg Testing

Editor, Science and Invention:

In Science and Invention for September there is illustrated an egg test for telling the age of eggs. I would like to know if the originator of the egg test has neglected part of his instructions or has failed to try out his theory. Fresh eggs will float in brine, but not in fresh water, and if the experimenter has eaten alleged fresh eggs which float in water, I fear that he has partaken of an extremely juvenile chicken.

John C. Plimp,
Columbus, Mont.

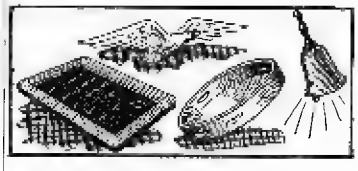
(The caption under the picture of the egg testing system should have mentioned that salt water be employed for making the test. The eggs in every case are floating in salt water. The brine concentration is regulated so that a fresh egg will float in the approximate position indicated in the first photograph. The importance of the entire test depends, of course, on the angle at which the egg floats, being subject to the air cell at the top.—EDITOR.)

Spirits

Editor, Science and Invention:

I would like to receive your prize conditions for "Spirits."

I can assure you that I am not as terrible as you perhaps may think.



While I would like to try to win your prize, I am nearly convinced that your conditions consist in unsurmountable difficulties for test proof. I, therefore, am afraid your prize will always remain in your safe, and never serve its purpose; that is to say, you will never get the evidence you want. Nevertheless, I should like very much to see your conditions, if it were only for criticizing them in my ability as an expert in this matter.

Why not make all possible effort to find out the laws and thus get the *Control* over a new force, which could lead us to yet unknown practical results.

Mrs. Anna Langheinrich,
Genova, Italy.

(That is exactly what we are anxious to do, viz., get the phenomena and then establish the laws therefor. Here is a resume of the spiritualism contest.

In the June, 1923, issue of Science and Invention *Magazine, this publication started its first spiritualism prize contest. In this issue a prize of* $1,000.00 *was offered for any spiritualistic manifestation or any other effect imputing supernatural or spiritualistic claims which were devoid of trickery and which could not be exactly reproduced by natural means. From the contest were excluded automatic writings as these are considered to be sub-conscious effects. This contest expired on May 1st, 1924, and has since been repeatedly reissued. Two months later in the August, 1923, issue of* Science and Invention, *Joseph F. Rinn offered through this same publication the sum of* $10,000.00 *in addition to the original* $1,000.00 *already posted. The conditions of this prize contest were as follows:*

$1,000.00—*To any person who will read what is on the pages of a book opened at random by me and placed open behind their back during the test.*

$1,000.00—*To any person who will produce a readable message of any sense on an ouija board, the letters of which have been transposed from their usual positions, and the performer to be blindfolded and his ears stuffed with cotton by me.*

$1,000.00—*To any person who will cause a message to appear on the inside of slates joined together and provided by me, which during the test are to remain beneath the bosom of my shirt. If removed for examination, new slates to be provided by me for further tests.*

$1,000.00—*To any person who will prove telepathy or the power of two persons to communicate with each other by thought, after being blindfolded, their persons secured, and their ears and mouth filled with cotton by me.*

$1,000.00—*To any person who will accurately describe something definite going on at a distance in a place selected by me, or who will predict in advance an event or calamity of such a definite nature that it would be impossible for such person to have any controlling power over or previous knowledge of the same; or who will produce a picture on a negative supplied by me while the same is in a locked safe and in a room provided by me.*

$5,000.00—*To any person who after being searched and secured by me shall produce from their mouth or body what is called ectoplasm, and which shall shape itself into definite forms of hands or faces*

OR ANY PERSON

who will prove under scientific conditions laid down by me that the spirits of the dead can communicate with the living.

This challenge was also repeated every year. In November, 1926, *Mr. Joseph Dunninger added another* $10,000.00 *to the original* $1,000.00 *offered through this publication, bringing the total in spiritualistic prizes up to* $21,000.00. *The conditions of this* $10,000.00 *award were identical with those originally listed.*

In May, 1928, *Mrs. Beatrice Houdini, the widow of the illustrious handcuff king and arch foe of fraudulent mediums, offered through this publication an additional* $10,000.00 *for the ten-word message agreed upon between her husband and herself. Mr. Houdini repeatedly reiterated that this would be the one message which he would use as the key toward spanning the barrier between the spirit world and this world. If some of the words of this code are received in the correct order, the proportional amount of money will be paid. Altogether there is a total of* $31,000.00 *awaiting the individual who can demonstrate his or her ability to communicate with the spirits, or produce the manifestations listed.*

Helicopters

Editor, Science and Invention:

I have just read Mr. MacCracken's letter, *Kansas City Journal Post Magazine,* in which he cites the need of larger and better airports and more of them for both the larger and smaller sized cities if the country is to take care of aviation needs along the line of better business. He takes the view that the city or two that encourages aviation from a business standpoint will certainly profit by so doing. That is all very true and I heartily agree with him, and that the sooner the country takes that view of the matter and puts forth their best efforts along that line, the better for business in many ways, as Mr. MacCracken sets forth in his article.

But as I look at the situation, inventors have got to get busy. In this day, land values near towns and cities are so high that adequate accommodations for airports in many instances are almost out of the question. In many places there are no large tracts available for the purpose. Now what I mean by inventors getting busy, is to build a plane that will not require so much runway in starting.

W. M. Elwood,
Troy, Kansas.

(We thoroughly agree with you that aviation will become universal when a vertical-rising plane has been invented, one that will be entirely practical. The present generation will see this come to pass. However, airplanes today cover many miles and fatalities are of a very small percentage when one compares the mileage covered by the airplane with the mileage and the number of fatalities in automobiles. The greatest inconvenience to the use of airplanes is, of course, the lack of suitable landing fields. There should be more.—EDITOR.)

Atlantis and the Aleutian Islands

Editor, Science and Invention:

Science and Invention is getting more interesting all the time, and it is really astonishing what a wealth of information a single issue contains. The article in your August issue entitled "Atlantis" is really fascinating and I firmly believe that such a continent has existed. It reminds me of the Aleutian Islands, where I spent the larger part of 1922. They clearly show that they are only tops of mountains that went down into the ocean during a terrific submarine earthquake thousands of years ago, one similar to the one that submerged Atlantis. The earth covering the islands is volcanic ashes and lacks certain chemicals that are necessary for growing plants, and especially vegetables. Spinach grows fairly well, radishes have a nice appearance, but are hollow inside, while potatoes are a complete failure, as are trees.

If the Aleutian Islands had been submerged completely, we would have another Atlantis.

G. G. Krause,
San Francisco, Calif.

(Thank you both for your compliment and your scientific comment. There have undoubtedly been many areas like the mythical Atlantis on this planet. Undoubtedly continents rose and fell while the earth was cooling and molding. Fortunately, our records can inform posterity of the existence of islands and continents now well known which may be but the floor of the ocean thousands of years hence.—EDITOR.

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Television Broadcast

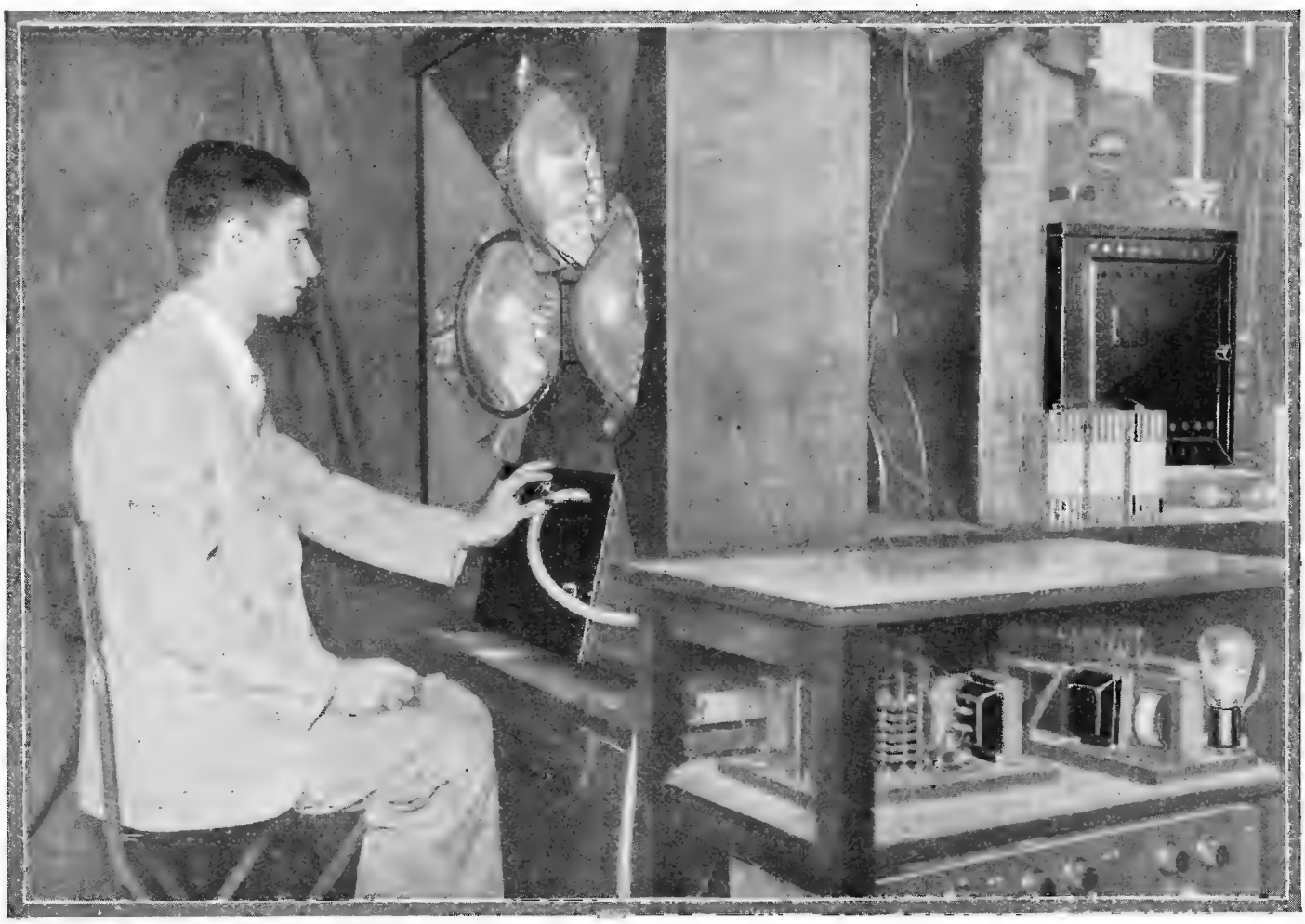
Television Programs Now Broadcast by Radio News Station WRNY

Successful Images Received

Television *is* HERE

Television Transmitter Described

THE first regular broadcast of television was inaugurated in New York City by Radio News Station WRNY. This station now transmits images daily on a wavelength of 297 meters, and also on 30.91 meters through its short-wave station W2XAL. John Geloso, chief engineer of the Pilot Electric Mfg. Co., has perfected the televisor now in use. He was assisted in his experiments by the technical staff of RADIO NEWS. On August 12th, the transmitter was moved from the Brooklyn Laboratories of Pilot, to the transmitting house of WRNY, at Coytesville, New Jersey. An experimental receiver was placed about a quarter of a mile from the transmitter, and images were received successfully. After this private exhibition a demonstration for the public was given at Philosophy Hall, New York University, on August 21st. Although no synchronizing system was used, satisfactory images were obtained. The first printed radio program listing television transmissions appeared on the morning of August 21st, in the *New*



A general view of the Pilot televisor used at WRNY. The powerful arc light is in the square black can at the extreme right. The edge of the scanning disc is visible above the top of the small table, which holds the audio amplifiers for the photoelectric cells, which are the large round objects faced by the subject being televised; they are shielded by copper mesh. Above, the author of the accompanying article is shown adjusting one of the amplifier control rheostats, while he is being "televised." A shielded cable runs from the photoelectric cells to the amplifiers on the table. Note arrangement of photoelectric cells. Robert Hertzberg shown above.

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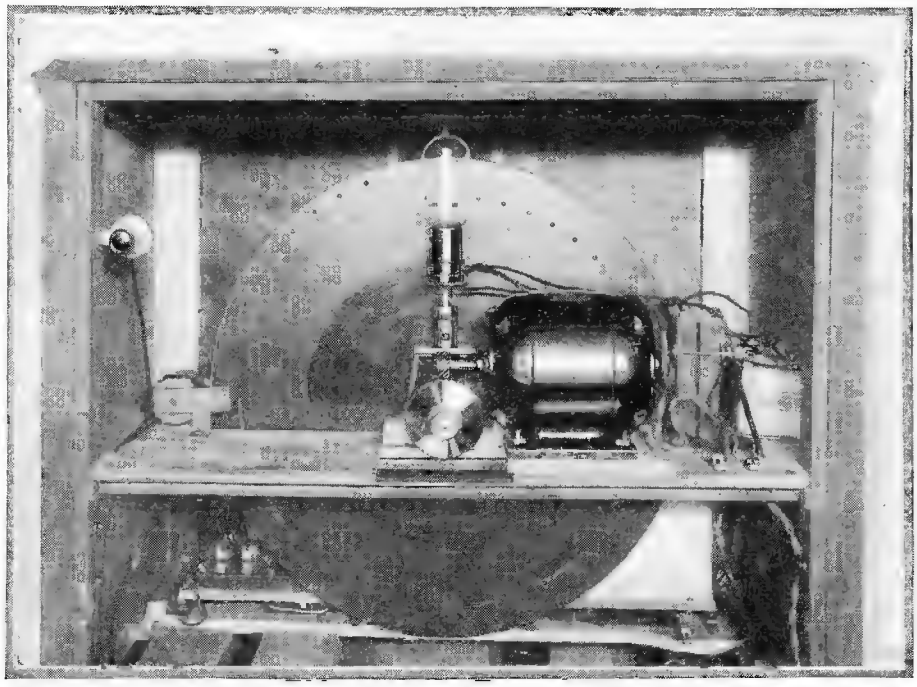
The photograph above and to the left shows a back view of a television and broadcast receiver. The scanning disc, driving motor and neon tube occupy the top portion of the cabinet, while the audio amplifier and power-pack are placed in the bottom. To the right of this photo is a front view of the receiver, with John Geloso viewing the images through the square opening at the top. This receiver was used in the demonstration given at the New York University. The photo at the bottom of the page gives a close-up view of the scanning apparatus. A synchronous A.C. motor is used.

York Times. Television images are now broadcast regularly by WRNY and W2XAL on the first five minutes of every hour that these stations are on the air. Longer periods for tests by experimenters are being given; watch newspapers for exact time.

The Transmitter

THE transmitter consists of four major units, an arc lamp, a scanning disc, a bank of three photo-electric cells and an amplifier. The person to be televised sits in a covered booth facing the photo-electric cells. These are arranged in a form of a triangle through the center of which is an opening about six inches square. On the other side of the frame holding the cells is a scanning disc, 24 inches in diameter having a spiral of 48 holes. This disc rotates at a speed of 450 revolutions a minute, and light from the electric arc passes through the holes, falling on the face of the subject. The side of the disc facing the arc is masked, so that only one hole at a time transmits light to the subject being televised. With this arrangement, a series of 48 separate rays of light flash across the subject's face. The reflected light from the subject falls upon the photo-electric cells, producing a current of electricity which corresponds to the intensity of the light received. The impulses produced by the cells are amplified by resistance-coupled amplifiers and then fed into the modulator tubes of the transmitter. The signals thus sent out may be received by anyone having a television receiver within reception range of the station.

At the receiving end the signals are tuned-in in the normal manner but, instead of being made to operate a loud speaker, are led after being amplified to a neon lamp which is fixed behind a scanning disc identical in dimensions and arrangements of its holes to the one employed at the transmitter. This disc also is rotated at the rate of 450 revolutions per minute. The glow tube produces a pinkish glow which varies in intensity in accordance with the electrical impulses received; just as a loud speaker produces sound in accordance with the variations of the current flowing through it.



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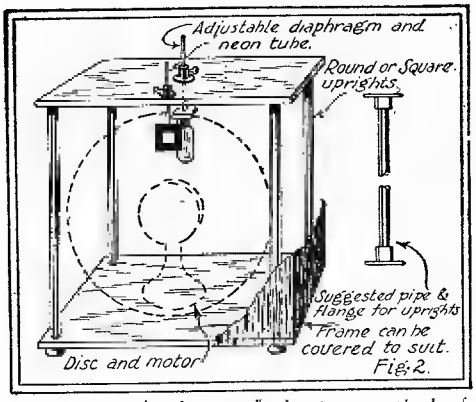

Adjustable diaphragm and neon tube.
Round or Square uprights.
Suggested pipe & flange for uprights
Frame can be covered to suit.
Disc and motor
Fig. 2.

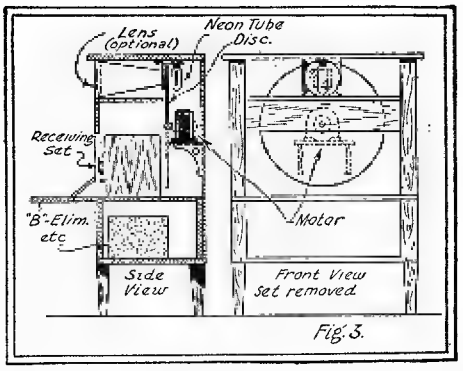
About the simplest and cheapest method of mounting the television receiving disc and motor, together with the neon tube and viewing diaphragm, is illustrated above. The upper shelf is supported on wood or pipe.

TELEVISION *Receiver* HINTS

By

HENRY TOWNSEND

Some Practical Points to the Novice, About to Build His First Television Receiver



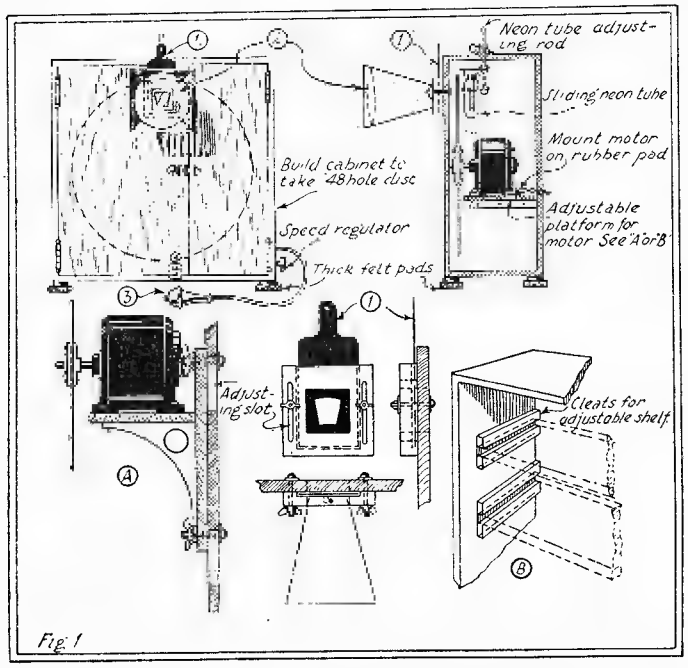
A neat arrangement of the television receiving disc, together with neon lamp and viewing hood—all combined in your present radio console cabinet, is here illustrated. An idea worth noting.

Cabinets

FOR those who are making their first attempts in trying out television apparatus for the reception of moving images or perhaps motion pictures, as transmitted from the Jenkin's laboratory in Washington, D. C., on short waves, probably a simple frame such as that illustrated in Fig. 2, will prove the cheapest and simplest way in which to mount the disc and motor, together with the neon tube and diaphragm. The purpose of the diaphragm is to block out all of the holes in the disc except one at any given instant. When using a large disc where the television image may be approximately the same size as the plate in the neon tube, the diaphragm may be dispensed with, but the writer would strongly recommend its use in every case where sharp clear images are to be reconstructed. If more than one illuminated hole in the disc is exposed to the eye at one time, there is bound to be loss of definition in the image.

In the illustration at Fig. 1, a few suggestions to the cabinet builder are presented. If the motor shelf is to be made stationary, then the viewing hood and the neon tube should be made adjustable as to height, so that when various diameters of discs are used to receive from the different stations, the hood and the neon tube may be moved up or down, so as to be in line with the spiral of holes on the disc.

If it is desired to make the viewing visor and the neon tube stationary, then the disc and motor should be made movable vertically. To accomplish this purpose, the motor shelf may be arranged to slide into several sets of cleats, nailed or screwed to the side walls of the cabinet. Another scheme is shown at Fig. 1-A, where the back of the motor support shelf is arranged with wing nuts and bolts, so as to slide in a pair of slots cut through the back wall of the cabinet.


Neon tube adjusting rod
Sliding neon tube
Mount motor on rubber pad
Build cabinet to take 48 hole disc
Adjustable platform for motor See A or B
Speed regulator
Thick felt pads
Adjusting slot
Cleats for adjustable shelf
Fig. 1

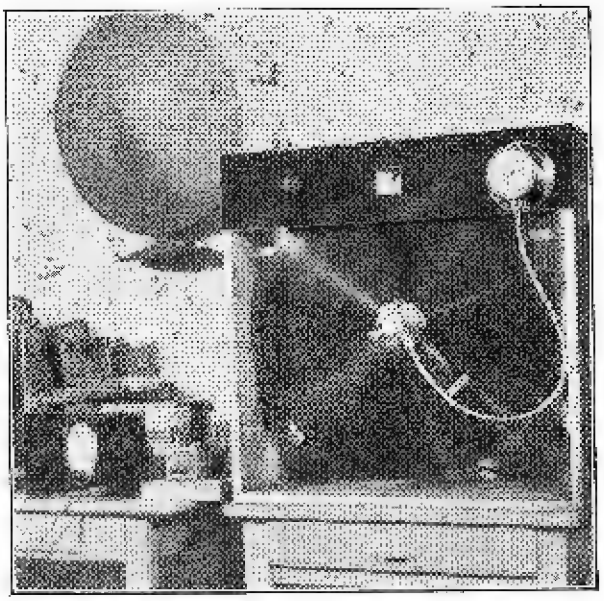
The illustration above shows several practical hints of interest to the television experimenter. If the disc motor is not to be made adjustable as to height for different discs, then viewing hood and neon tube must be made adjustable, as shown.

Adjustable Visor

By looking at the illustration Fig. 1, it will be seen how easy it is to construct an adjustable visor. This has slots cut in either side of the baseboard supporting the visor, so that when the wing nuts are loosened, it can be slid up and down. Of course a sufficiently long slot must be cut in the door of the cabinet to permit viewing the disc at the various positions of the visor, as it is moved up or down. By making the doors of different widths, as shown in Fig. 1, it will be seen how the visor is carried on the wider left-hand door, whenever the doors are swung open to permit changing discs or making adjustments to the apparatus in general. This and some of the other ideas here presented are due to H. W. Secor.

In Fig. 3, one method of mounting a television disc and motor in a console cabinet, together with the radio receiving set, is shown. The opening fitted with optional lens for viewing the picture, is arranged in the front of the console cabinet. Many other variations of this idea will suggest themselves, of course, to the home-mechanic and experimenter. Another idea, for example, would be to mount the perforated disc outside of the cabinet, on the back, as in the case of Fig. 3, thus enabling the experimenter to change discs more easily. The neon tube could be mounted on a bracket or in a small box close behind the disc. Any one of several methods such as those shown herewith, may be employed to adjust the motor up and down, so as to bring the various size discs into proper align-

(*Continued on next page*)



The television receiving apparatus shown at the left is that built by Mr. James Millen, of Malden, Mass. On this apparatus Mr. Millen received the Jenkins' radio movies. Note use of tachometer to indicate the speed of the disc at any instant.

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Television Receiver Hints

ment with neon tube and visor. The inside of the television receiving cabinets should be painted a flat black in any desired color. The inside surface of the viewing visor or hood should be painted with lamp black and alcohol, or else flat black paint. The surface of the disc should be finished flat black, as most of the commercial ones are already. The motor, in any case, should be mounted on rubber or felt to minimize vibration, and it is well to set the cabinet feet on rubber or felt cushions also.

Television Discs

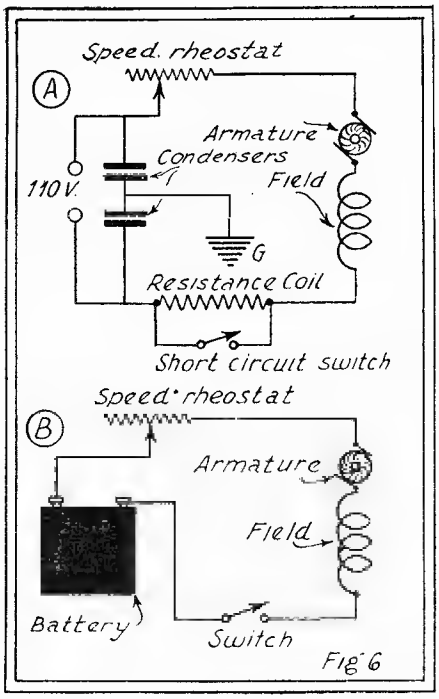
THE average television experimenter will probably purchase his perforated disc from some manufacturer, as there are a number of them supplying the different size discs now on the market. To those desirous of making their own perforated disc, the writer would refer them to Volume 1, No. 1, of *Television* magazine, where complete details are given for the laying out of the holes for any size disc, and also the exact method of determining the proper size of the diaphragm opening.

Referring to Fig. 5 for the moment, one suggestion for making a universal disc is given, and the experimenter may care to utilize such a plan. Here the various spirals containing different numbers of holes, now in popular use for television and radio movie transmission and reception, are all incorporated in one disc. In this case the motor would remain stationary in the cabinet, and the viewing visor and the neon tube would be moved vertically up and down, depending upon which station and corresponding spiral of holes you were going to use at the moment. The motor speed will have to be changed by adjusting the rheostats, etc., correspondingly.

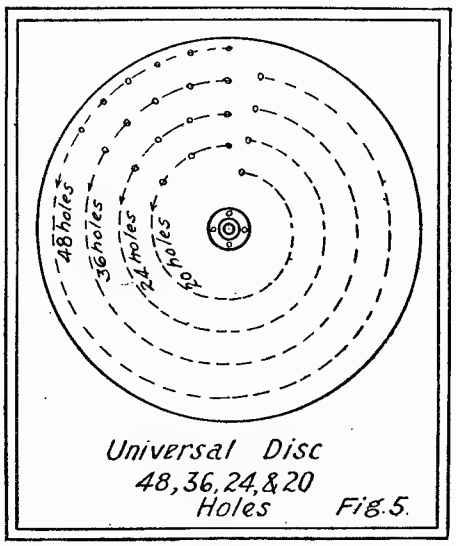
In order to ensure greater constancy of revolution of the disc, especially at low speeds, it would seem a good idea to have a heavy rim on the edge of the disc, so as to give greater mass and consequent momentum to the disc. Doubtless some of the manufacturers will be putting out a disc with a heavy metal rim on it a little later. Unless a synchronous motor is used, it will be found that slight fluctuations in speed will frequently occur, owing to the small mass of the armature in the average 1/16 horsepower motor used for whirling the television disc. These speed fluctuations will not be so noticeable where a heavier motor, such as the ⅛ horsepower type, is employed.

When a motor having a shaft projecting from both ends of the frame is available, you may try mounting a small iron flywheel at one end of the motor shaft, in order to give greater constancy of rotation. For some time to come, and until television transmission stations reach some joint agreement, whereby they will all use a disc containing a fixed number of holes, the experimenter will have to put up with the proposition of changing the disc when listening to different stations.

At present twenty-four hole and forty-eight hole discs seem to be the most popular with the television broadcaster. Under these conditions, the write would suggest that the experimenter can easily work out some quick releasing clutch for holding the disc, so that when the cabinet doors are opened, a disc can be easily removed from the motor shaft and a new one inserted in its place. One of the simplest ways in which to do this would be, no doubt, to provide a bushing with a large threaded wing nut and flange on the front of the bushing, cutting out two quarters or other even fractions of the threads in the same way as the breech block of the modern cannon is arranged. This will enable the operator to release the threaded wing nut, by simply turning it through a fraction of a revolution. Another simple scheme would be to have the shaft fitted with, say, two pins, arranged to pass through holes drilled in the disc; and design a front flange plate with a spring-like arrangement, so that it could be quickly removed with the pressure of the fingers. If the universal disc (Fig. 5) is used this is unnecessary.



In the diagram at A, one of the preferred methods of connecting the disc driving motor is shown; periodic short-circuiting of the lower resistance coil speeds up motor.. Diagram B shows storage battery motor drive.

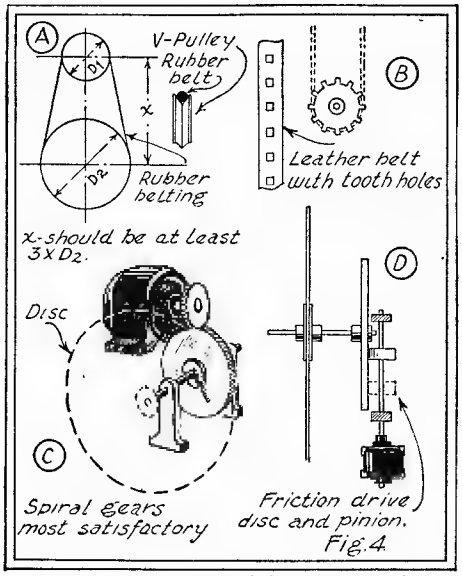


One method of simplifying the television receiving apparatus is that involving the design of a universal disc, containing the various numbers of holes now in use. With such a disc, the viewing hood and the neon lamp must be adjustable as to height.

Television Motors

WITH regard to television motors, we have already mentioned that the disc driving motor should in every case be mounted on rubber or felt washers, placed under the feet of the motor so as to absorb any vibration. Perhaps the most important thing to the television experimenter is the proper choice of the motor in the first place. It may be said in general that a 1/16 horsepower motor has been found suitable for driving all size discs, including a forty-eight hole specimen, when the disc itself is of the thin metal or bakelite type (1/64 to 1/32 inch thick). When a very large disc, say of the two- foot diameter type, made of 1/16 inch or thicker metal, such as the *National*, and provided with a heavy hub, is used, then a ⅛ horsepower motor has been found necessary.

If you are not going to utilize an adjustable speed control of the mechanical type, such as belts, gears or friction transmission, then you will have to depend, of course, upon the electrical speed regulation of the motor iself. Here it is important to watch out in purchasing a motor that it is not of the A.C. type (providing you have A.C. supply) wherein contact rings are thrown out by centrifugal force as the rotor speeds up toward its normal 1,750 revolutions per minute. Such a motor cannot have its speed regulated accurately, down in the vicinity of 450 r.p.m., which is the speed of rotation now in use by at least one station—WRNY. Induction motors have a very poor speed regulation characteristic, and it is preferable to use at least a ⅛ horsepower motor, if it is of the induction type, unless the (*Continued on page* 753)



Various methods of driving the television receiving disc by means of belts, gears and friction pinion, are shown in the drawing above.

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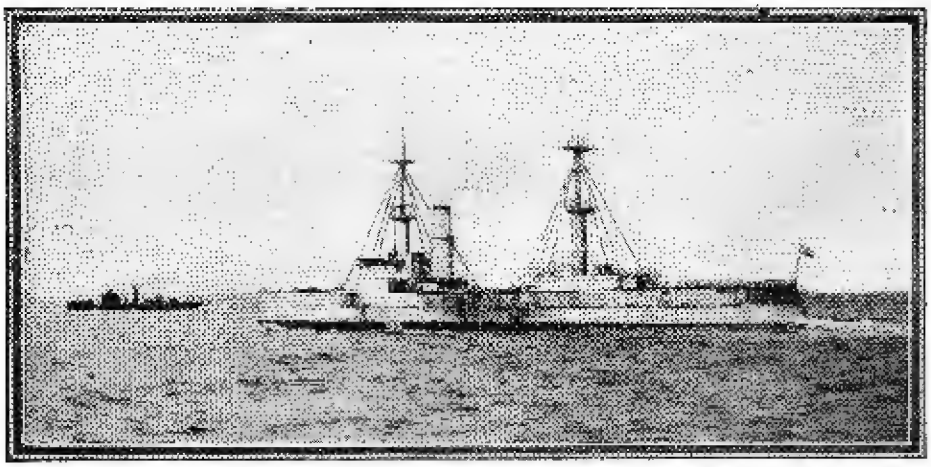
RADIO DEPARTMENT



The radio battleship Zahringen which is used as a target for the German Navy appears above.

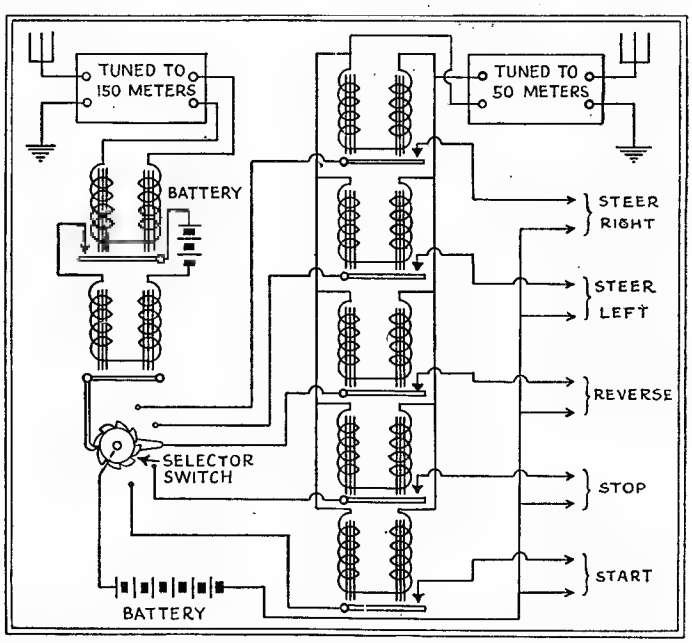
Battleship Controlled *by* RADIO

Air Waves Command Boat from a Distance

WHEN the German Navy entered the North Sea for target practice and maneuvers it was accompanied by a most peculiar craft seemingly a "mystery ship." Although no one was on board, the boat followed the fleet and kept obediently on its course. The former German battleship Zahringen had been rebuilt and fashioned into a radio controlled life-size target. To all outside appearances it appears to be an antiquated battleship but once within the hull no crew whatsoever is visible. Furthermore, the boat is filled with cork and will keep afloat even if seriously damaged by gunfire. On the top of the mast is an antenna which receives the impulses from the control ship. If the first antenna is shot away, a second one is automatically connected to the receiver. If this is shot down, two red rockets are fired, showing that the ship can no longer be directed by radio. The maneuvers of this target are directed from the destroyer Blitz. A photograph of the transmitting control appears on this page.

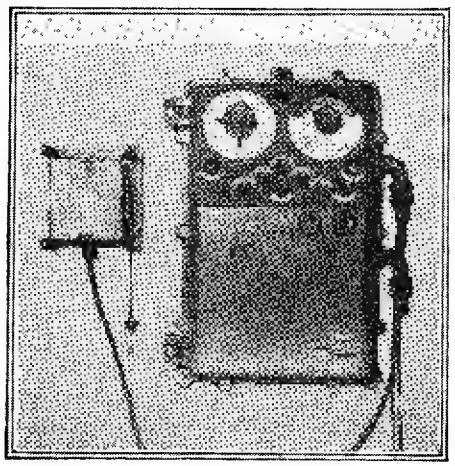
The radio-steered target offers much better training to the gunners than the regulation fixed or floating targets used heretofore, because the movements of the target ship can be directed from a distance at the will of the operator at the transmitter and maneuvers similar to those used by ships under fire during wartime can be easily duplicated. With the news of the latest radio-controlled boat, word comes from England that Prof. A. M. Low, the famous scientist, has invented a new transmitting gear to be used with the radio-control of moving objects. Prof. Low is shown on this page with a portion of his apparatus.

Of course, for complicated control an expensive and intricate system of relays, switches and other apparatus is needed. However, a simple radio-control system can be made as shown in the schematic diagram appearing here. There are two transmitters and two receivers used in this simple system operating on two different wavelengths. One of the transmitters actuates a selector switch which closes one of the circuits for operation. However, nothing will happen until a dot is sent out on the second transmitter which connects the battery in the circuit. The relay will flip over and put into operation the circuit chosen. Amplifying relays have been left out in order to simplify the circuit. This control system is readily adapted for directing the movements of small objects and models from a distance.



Above is a simple arrangement which can be used for controlling small boats and models from a distance.

The above photo shows Prof. A. M. Low with his latest invention used for the radio-control of moving objects.



The photograph at the left shows the radio transmitting apparatus control board which has been installed on the destroyer Blitz. This is used for directing the movements of the ship shown at the top of the page. The boat under control follows exactly the will of the radio operator on board the commanding ship.

Two small receivers permanently tuned to prechosen wavelengths will be needed in the model. For control over short distances, the transmitter need not be elaborate, and low power will be suitable for radio-directing.

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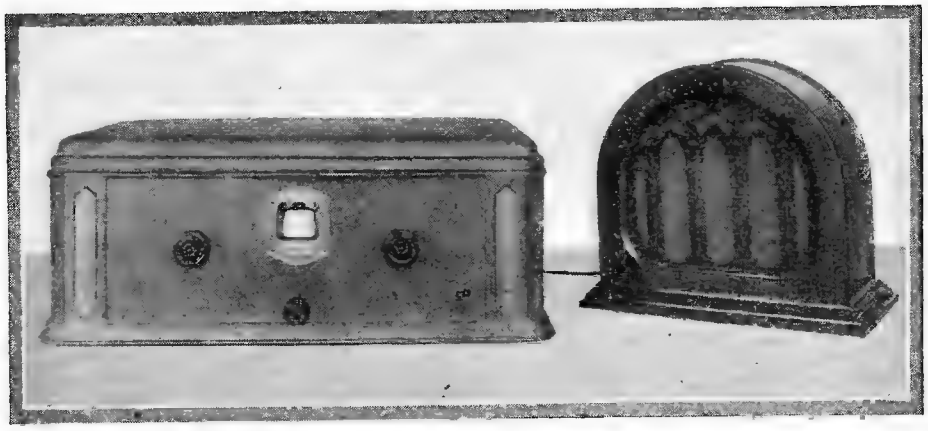
Three Stages of R. F. and Single Dial Control Are Used.

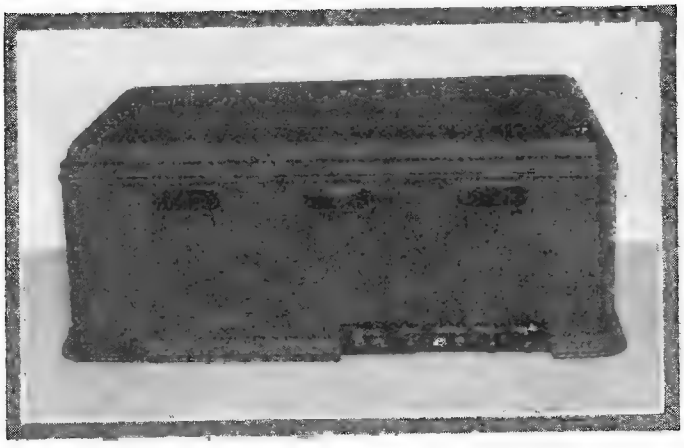
A New A. C. Set

A totally shielded receiver of the neutrodyne type which employs heater type tubes throughout is described here



A front view of the new six-tube A.C. receiver appears in the above photograph. The knob at the left is a vernier adjustment, the knob at the right controls tuning, and in the center is the volume control

A NEW six-tube all-electric radio receiver of efficient design and artistic appearance is now being made by a well-known eastern manufacturer. The design of the set has been well engineered and is the only one which has come to our attention that uses all 227 heater type A.C. tubes except one. These tubes are used in the first and second and third radio frequency stages, in the detector and first audio. A 171A power tube is used in the last audio stage. Current supply for the filaments of these tubes is obtained from a dry A eliminator which is housed within the receiver. A 280 thermionic rectifier tube is used in the B and C eliminator.



A rear-view of the receiver appears here. The pin jacks for speaker and phonograph pick-up may be seen, as well as the binding posts for antenna and ground.

Design

THE set has been designed to operate on alternating current circuit 110 to 130 volts, varying between fifty and sixty cycles. However, special provision is made on the power transformer, so that by shifting a connection the set will be ready to operate on alternating current circuit between 90 and 110 volts. When shipped from the factory, the receiver is adjusted for use on line voltages from 110 to 130 volts.

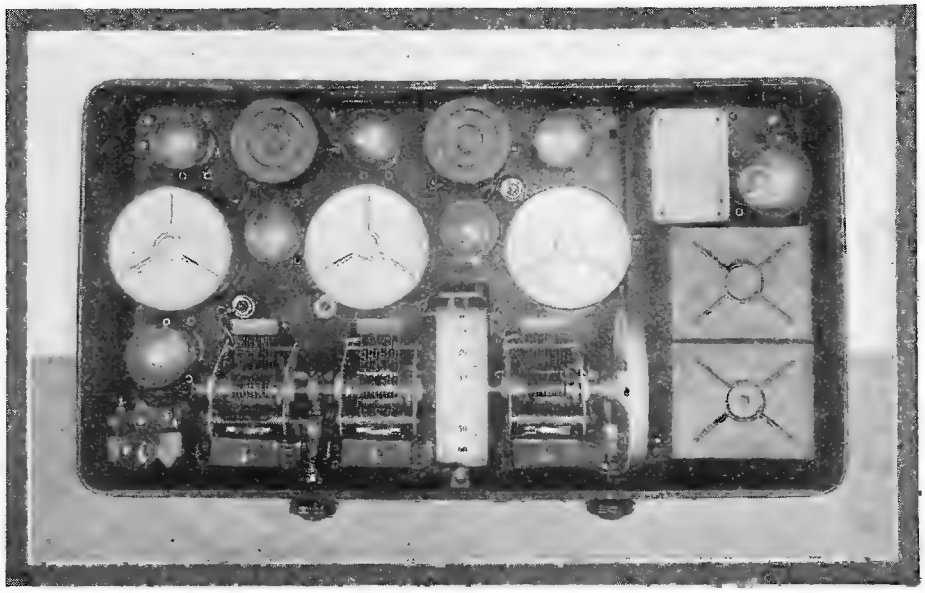
The receiver itself is built upon a solid, one-piece pressed steel chassis. The variable condensers are of the floating type and turn on a rigid shaft one-half inch in thickness. These condensers are substantially constructed and have large bearings so that they will operate smoothly and hold their calibration over a long period of use. All of the radio frequency stages are shielded with aluminum cans and each stage is neutralized by means of tapped primaries on the R.F. transformers. The two audio frequency transformers are also shielded and are placed at the rear of the chassis. The power unit is contained on the right, inside of the case, as may be seen in the accompanying photograph.

Rejector

AN added improvement is what is known as the rejector; this is a wave trap, by means of which station interference can be eliminated. The rejector is tuned to the undesired station, and volume is reduced to medium intensity. The rejector knob is now turned slowly until the station is the weakest. The receiver can then be tuned to any other desired station without experiencing interference from the undesired station.

Controls

BY referring to the photograph, which shows a front view of the set, it will be seen that there are three knobs. The knob at the left controls a vernier adjustment of the first radio frequency stage tuning condenser, the knob in the center near the bottom controls the volume and the knob at the left is used for tuning. The drum dial and condenser assembly is operated by this knob through the means of a friction drive which provides positive action without slipping. A small toggle switch is used for turning the set on and off and is placed near the bottom at the extreme right. An illuminating drum dial, set behind a recessed window, calibrated in the usual manner and in wavelengths, enables stations to be tuned in and logged easily. At the rear of the set are three binding posts, one is for the usual ground (*Continued on page 777*)



An interior view is shown above. Two audio transformers are placed at the rear of the receiver. The three large shields contain the radio-frequency coils. The rejector is placed in the front at the left-hand side.

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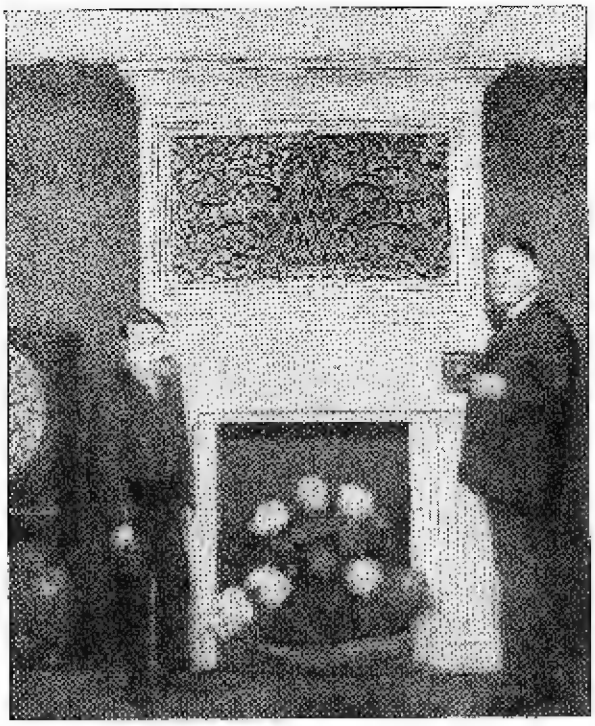


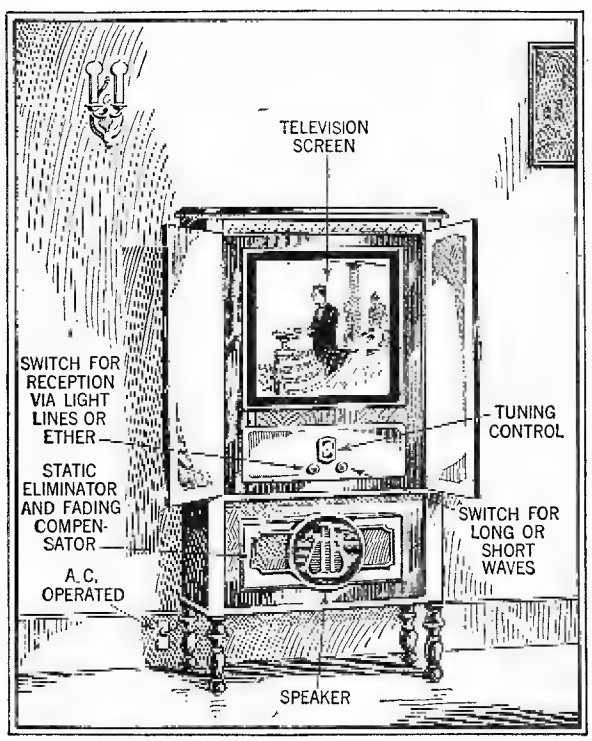
The above photograph shows the modern trend of speaker design. The mantelpiece houses the horn.

FUTURE RADIO Receivers

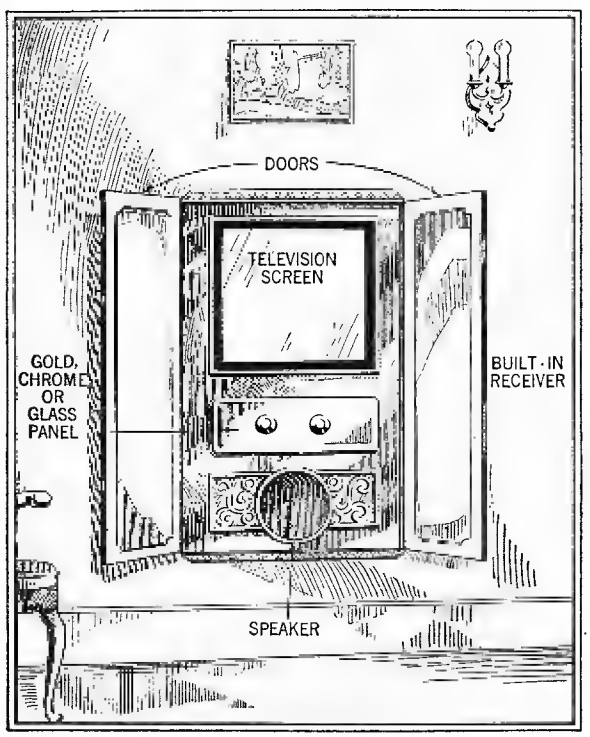
Dr. Lee de Forest Makes Some Predictions. Television and Radio Sets of 1938 Visualized. Static Eliminator and Fading Compensator Will Improve Reception.

WHAT will our radio receivers resemble ten years from now? We are justified in hoping that satisfactory television, perhaps in colors, will invade our homes, as radio is doing today. Dr. Lee de Forest, well-known radio engineer and inventor, has made several interesting prophecies concerning sets of the future, which have been illustrated here. For private homes, the receiver will be an artistic and beautiful piece of furniture of the console type but larger than the present-day console, because it must house both a radio and television receiver. On the front panel will be a control for the programs and another for the television channels. In the bottom portion of the cabinet will be placed a static eliminator, perfected during the next ten years. This eliminator will probably take up considerable space, and therefore the console will be quite tall. Besides the static eliminator we will have incorporated in the bottom portion a fading compensator which will keep the volume of all stations constant. It is certain that the quality of reproduction will have been improved to an astonishing degree. Electro-dynamic speakers will be placed in the bottom of the sets, with exponential horns built into the walls, or the speakers might be placed above the fireplace, as shown in the photograph. Long or short waves will be received by simply operating a switch, and radio programs will come to us over the light lines as well as through the air. The apartment house receiver will be built into the wall and covered by doors, suggesting a small closet. The front panel will be finished in gold, chromium-plated or, perhaps, will be made of glass. A television screen will be placed at the top, with speaker below the set. It is expected that exponential horns will be built into the apartment during its erection. Each room will have its own speaker. Naturally, all receivers will be operated directly from the light socket.

The modern trend of loud speaker design is well illustrated in the photograph here.



The radio receiver of the future for use in private homes has been illustrated above. Television images and programs are received simultaneously.



In apartment houses the radio set, speaker and television screen will be built-in and covered by doors when not in use, as illustrated above.

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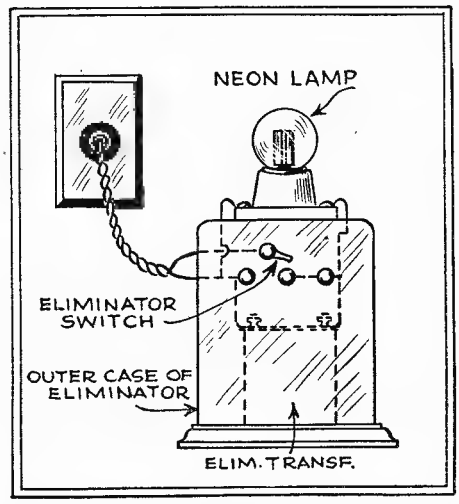
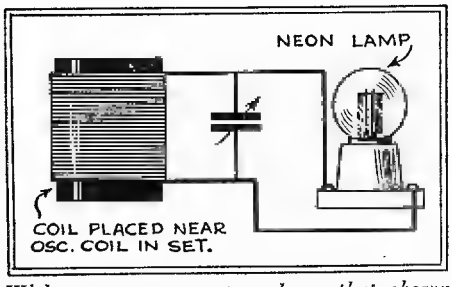
The Small Glow Lamp Can Be Employed Advantageously in Radio Work. It May Be Purchased for a Small Sum, and Its Usefulness and Applications Are Practically Unlimited. Hints for Uses Given Here.

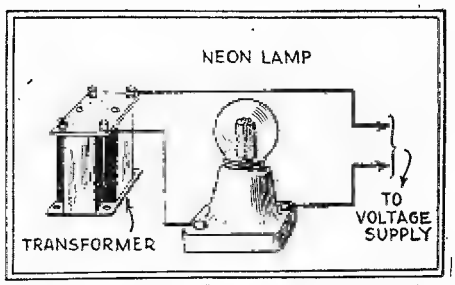


The above illustration shows how a neon lamp may be used as an indicator, showing when the "B" eliminator is in operation.

How to Use Neon Lamps As Indicators and for Testing Apparatus

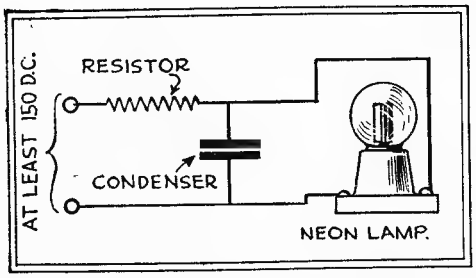


With an arrangement such as that shown it is possible to tell if the oscillator in a superheterodyne is working.

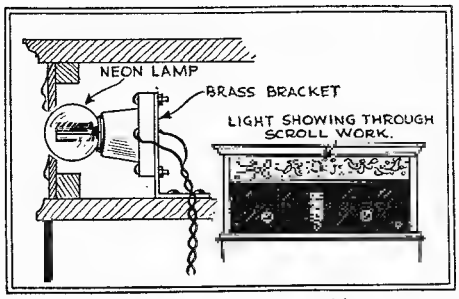


Transformers can be tested with a glow lamp as illustrated. Lamp lights if transformer is electrically perfect.

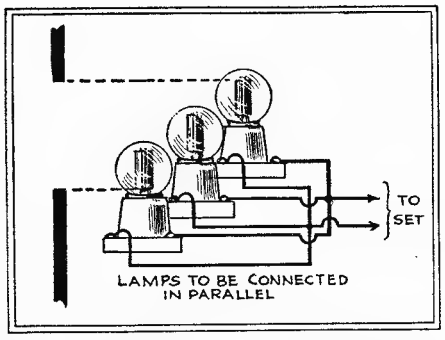
GLOW LAMP *Has* RADIO USES



The capacity of a condenser or approximate value of a resistor may be ascertained by using the above circuit.



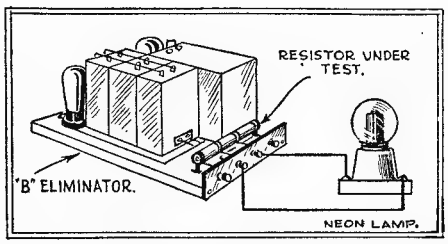
A glow lamp placed in the cabinet or console gives an artistic touch and also indicates when the set is in use.



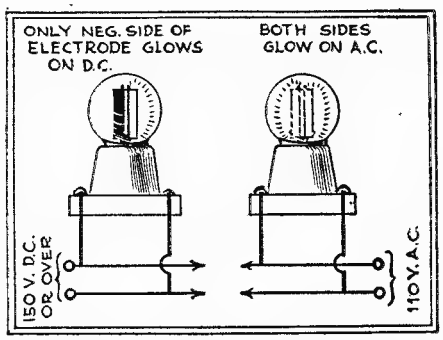
Three small neon lamps placed so that the glow surrounding the cathode slightly overlaps can be used in television receivers. These are to be connected in parallel.

THE small neon or glow lamp which is obtainable for a small sum has been used to some extent in the electrical field, where its applications seem to be much better known than in radio work. The radio amateur will find many positions where it can be used to good advantage in testing components, and as an indicator. A few of its many radio uses are illustrated here.

Occasionally tubes or apparatus are ruined when making changes in the receiver while the "B" eliminator has inadvertently been left connected. A neon lamp will forever eliminate this danger and is connected in the eliminator across the transformer primary terminals after the switch, if such is provided. If the eliminator is turned off from the light socket, the lamp is connected across the eliminator input (across transformer primary terminals). It can be conveniently mounted on top of the eliminator and will light whenever this instrument is turned on. Transformers can be tested for open circuits or (*Continued on page 747*)



The small lamp can also be used in place of a high resistance voltmeter for testing "B" eliminators, as illustrated.



The neon lamp can be used as an indicator of direct or alternating current. Both sides of electrodes glow on A.C., and only the negative side on D.C.

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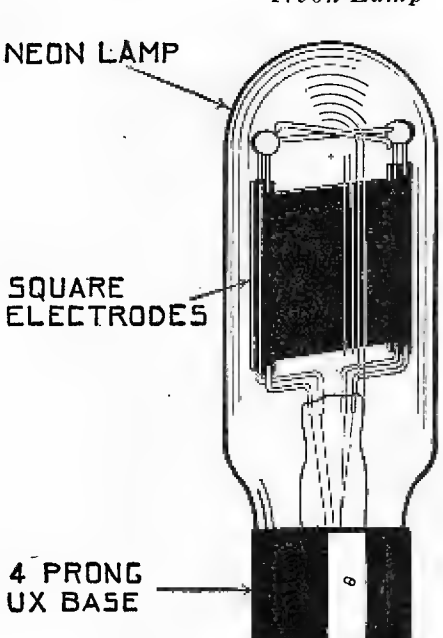
NEW RADIO DEVICES

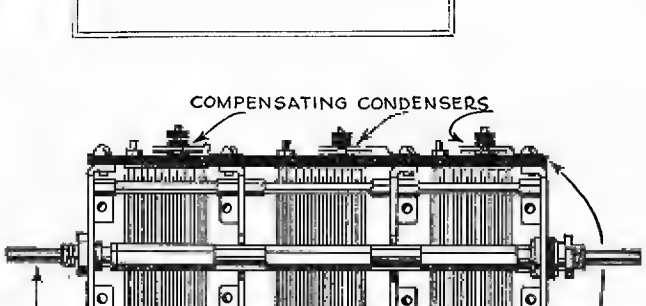
Neon Lamp



The illustration at the left shows the neon lamp for television reception which is equipped with a standard four-prong UX base. It measures 2 in. in diameter and is 5½ in. high. The glow over the surface of the cathode plate is uniform and the plates are put close together to prevent glowing between them.

A MASSACHUSETTS manufacturer has brought out a gaseous discharge glow lamp for converting electrical impulses into light variations, designed to be used for television reception. The two plates are 1½ in. square and are mounted so that they both present a clear surface. The tube takes about 220 volts to start, and draws approximately 15 milliamperes under average conditions. The dynamic resistance varies between 1,000 and 1,500 ohms, and thus it is suitable for use in the plate circuit of a 171.

Accessories recently developed which will be of value with any radio receiver. Each month the latest radio devices are described upon this page for the benefit of the set builder.



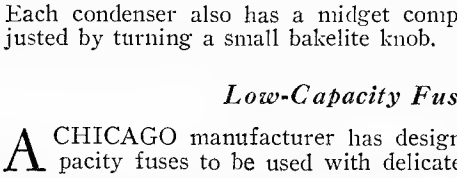
The triple gang condenser has been illustrated above. Each one of the condensers is equipped with its own compensator.

Gang Condenser

THE triple gang condenser illustrated has several new features and was placed on the market recently by a prominent Brooklyn manufacturer. The plates are made of brass, with stators insulated from each other. Removable shaft is split so that two of the condensers can be operated by one section of the shaft and the other condenser separately. Each condenser also has a midget compensator which is adjusted by turning a small bakelite knob.

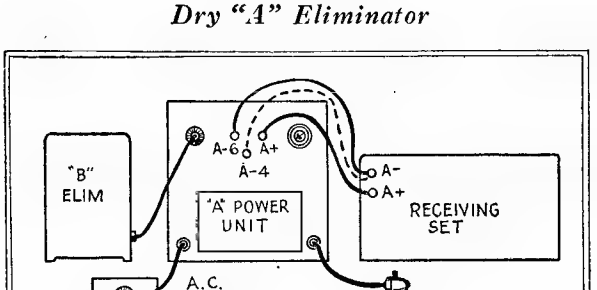
Low-Capacity Fuse

A CHICAGO manufacturer has designed a line of low capacity fuses to be used with delicate electrical equipment and in eliminators for radio receivers. The fuse link blows quickly on overload and offers ideal protection. The fuse itself is small, and about the size of a grid leak, when special connectors are used for receiving it. The quickness of action recommends the fuse to the set owner as a means for preventing damage. The fuses may be had in sizes up to three amperes.



The above illustration shows the small fuse and special connectors used with it.

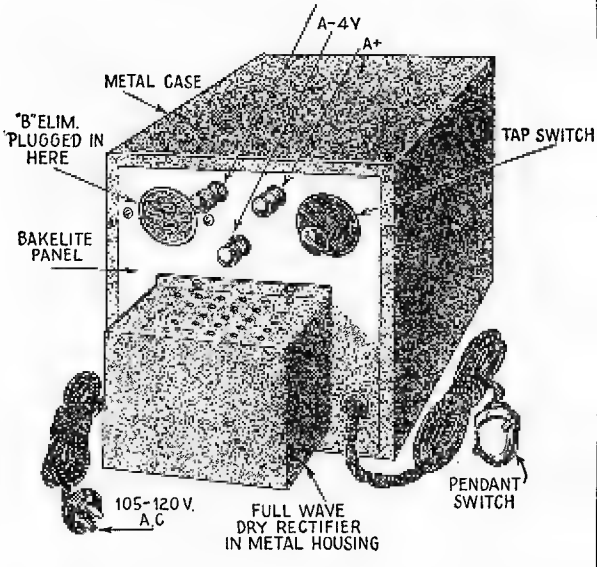
Dry "A" Eliminator



The dry "A" eliminator is connected to the receiver as shown above. Either four or six volts D.C. are available.

THE new "A" power unit shown here, the product of a New York concern, is entirely dry and silent in operation. Three dry large capacity condensers and two choke coils form an excellent filter system. A switch knob is provided for regulating the voltage and a pendant switch turns off the "A and B" eliminator when the set is not in use. The dry rectifier is housed in a box on the front and is easily removed for replacement. The entire instrument is enclosed in a metal case. It is obtainable both in kit form and completely assembled.

The eliminator may be used on alternating current circuits with voltages from 105 to 120 and will deliver both 4 and 6 v D.C.



The eliminator with its various features indicated is illustrated here. It may be used on 105 to 120 volts A.C.

Name of manufacturers furnished upon request.

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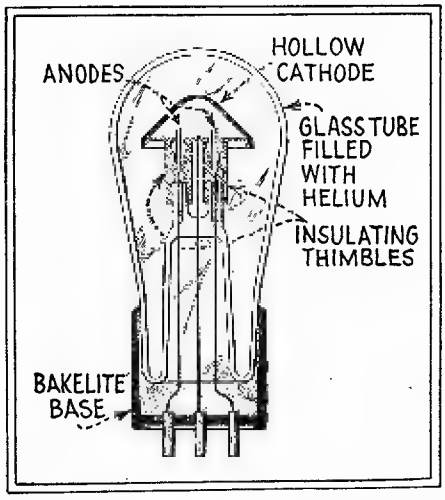
RADIO ORACLE

Gaseous Rectifier

(655) Howard Clyman, White Haven, Pa., asks:

Q. 1. If possible would you kindly give me some information regarding the construction of a gaseous rectifier tube such as made by Raytheon and publish an illustration of this tube?

A. 1. On this page you will find an illustration of a gaseous rectifier. This type of rectifier employs a glass envelope, a hollow cathode of tantalum, an anode, insulating thimbles and a base of insulating material. The tube or glass envelope is filled with helium, which serves as a carrier for the space current. The theory of operation of this device will not be described here, as this was explained in the Radio Oracle Department of SCIENCE & INVENTION for July, 1928. The cathode is formed in two parts, the upper part comprising a conically shaped element, and the lower part a cover which fits the open end of the cone. A portion of each insulating thimble is spaced from the anodes a distance materially less than the mean free path of the electrons present and serves to prevent the passage of current between either anode and the outer surface of the cathode. Ionization is thus confined to the space enclosed by the cone. In order to minimize the internal losses, the active portion of the cathode is coated with an alkaline substance. The cylindrical insulating thimbles contain circular recesses adjacent to the openings, which reduce the tendency of current to flow between the cathode and anode. In order to conserve the tantalum which is expensive, nickel pins are used coated with a thin band of the metal at the end and act as the anodes. Additional information concerning this rectifier will be found in the following United States patents: Numbers 1,679,449, 1,420,824, 1,617,171, 1,617,180, 1,499,078, 1,617,172, 1,617,178, 1,617,181, 1,545,207, 1,617,174, 1,617,179.



Above is a cross-sectional view of a gaseous rectifier such as that made by Raytheon and others. The glass envelope is filled with helium gas.

Loop Capacity

(656) Howard Moon, Weston, W. Va., writes:

Q. 1. I have a twelve turn box loop and would like to know if this may be changed in any way so that hand capacity can be eliminated or reduced?

A. 1. Hand capacity may be eliminated by removing the winding and rewinding by starting from the center of the frame and winding toward one edge of the loop. The wire is then run to the opposite edge and the winding is completed from this edge to the center of the frame. The two leads are thus brought out from the center of the loop, resulting in a noticeable reduction in the hand capacity.

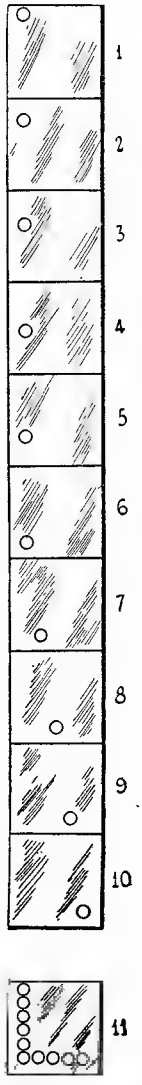
Persistence of Vision

(657) Walter Kimberly, Reading, Massachusetts, asks:

Q. 1. Will you kindly give me a simple explanation of the phenomenon known as persistence of vision and publish an illustration showing this principle as applied to television?

A. 1. If a flash of light is allowed to fall upon a photo-electric cell its current makes an instantaneous surge. This can be repeated fifty times per second and exactly the same number of times the current will rise to a peak and sharply fall to zero. If this same experiment is tried with a physiological eye, the brain will perceive only a continuous light. The effect of the first flash persists for a certain length of time, and if the next flash follows within this time limit, no discontinuity will be noticed. It illustrates and is due to persistence of vision. This phenomenon enables us to receive an illusion from the motion pictures where separate pictures or frames are flashed on the screen at a rate of 16 or more per second. Between each frame the screen is dark, but we perceive a continuous picture with natural changing scenes. The two effects, the photo-electric and physiological, are used in television. Imagine looking at a screen as shown in the illustration when a small spot of light appears at the upper left-hand corner. Even though the light appears for an instant it will be recorded on the brain as vision and will persist for more than 1/20 of a second. A few minutes later suppose a second circle of light to appear as shown at 2. If other flashes occur at later intervals and are located as shown successively in 3 to 10, and the last flash does not occur more than a twentieth of a second after the first one, the vision of each flash will persist while the light of the last one is registering, the brain will still perceive all the flashes which occur previous to the last. Thus, what is registered on the brain is not a succession of small circles of light but the letter L as shown at 11. This simple letter is taken as an illustration, but a picture of considerable detail may be formed in the total time of 1/20 of a second. If each circle of light lasts only one fifty-thousandth of a second 2,500 circles of light can appear to the eye successively and the last will be perceived before the vision of the first one ceases.

The phenomenon known as persistence of vision is well illustrated in the drawing below.



Noise Level

(658) Herbert McKellar, Euclid, Ohio, writes:

Q. 1. What is the meaning of the term "noise level"?

A. 1. The combination of all noises coming into a radio receiver is usually taken to be the noise level. These noises are caused by true static, electrical interference, by reradiating receivers or by any apparatus or device which forms electrical impulses which may be picked up by the receivers. The limit of radio reception is governed by the distance and power of the transmitter and also by electrical disturbances which drown out signals as soon as their intensity falls to a certain degree. A point is reached where the signal from the station has less strength than the impulses forming the noise level. It is then impossible to receive the station because the receiver will amplify the noises equally as well as it amplifies the true signal.

Audibility Meter

(659) William Laher, Ferndale, Michigan, asks:

Q. 1. How may the comparative strength of received signals be obtained?

A. 1. The comparative strength of a received signal may be indicated by an audibility meter. The careful comparison of two or more signals requires delicate instruments. Although the current received may be measured by sensitive galvanometers, the method requires careful manipulation and is not satisfactory. A simple method of obtaining good results is roughly to compare the signal strength when the phones are shunted with a known resistance. By reducing the resistance of this shunt until the signal is just audible, it is possible to calibrate the variable resistance so that comparisons with other signals may be made. If properly calibrated, the ratio of impedance of the head set and the impedance of the shunt resistance may be expressed in units of current and can be taken as the degree of audibility of the signal. Another method of determining signal strength is to compare the one signal intensity with another signal of known intensity produced by an oscillator using a high-pitched buzzer or a vacuum tube.

If the signal is just audible when 99 per cent of the detector current flows through the shunt resistance and one per cent through the phones, the signal is said to have an audibility of 100. For use in connection with an oscillating detector circuit, a simple series resistance is not sufficient to give an accurate reading. Changes in the constants of the oscillating circuit often cause variations in the phones which are out of proportion to the changes introduced. A series resistance must be added in the plate circuit to compensate for the reduction in resistance caused by the shunt resistance at the phones.

One simple method of comparing signal intensities consists in using a crystal detector and a galvanometer by means of which currents as small as 10 microamperes can be measured. This experiment requires careful manipulation, and information regarding it will be found in circular No. 74 of the U. S. Bureau of Standards. Careful comparison of two signals is a measurement which require apparatus available only in large laboratories. However, where accuracy is not of prime importance, any one of the approximate methods are satisfactory.

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SCIENTIFIC HUMOR

BOTH TOO FAST

"Ah ain't gwine run after no mo' trains."

"Why ain't yo'?"

"Cause I ran after one de odder day; and when ah' caught it, ah was two stations past whar ah wanted to get off!"—*Clem Walker.*

WHAT CITY?

HE: "I'm a little stiff from bowling."

SHE: "Where did you say you were from?"—*J. G. Van Bramer.*

ALWAYS AN OBJECTION

"Do you like these talking pictures?"

"Naw, they make it so hard for my girl-friend to hear what I'm saying."—*Gleason Pease.*

BRAIN WORK

FARMER: "Thought you said you had plowed the ten-acre field?"

PLOWMAN: "No, I only said I was thinking about plowing it."

FARMER: "Oh, I see, you've merely turned it over in your mind."—*J. G. Van Bramer.*

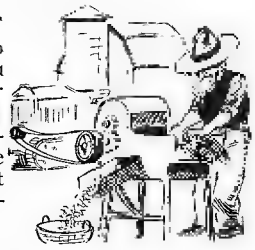
USED

"I can't give you two bits for this SCIENCE AND INVENTION magazine."

"Why not?"

"One page is full of 'wrinkles.'"—*Irwin Stillman.*

MEAT OR WIRE



"And of course," continued the radio salesman, "You must have your ground wires."

"Oh, that's alright," retorted the old farmer, "I've got a good grinder."—*Orland Krenke.*

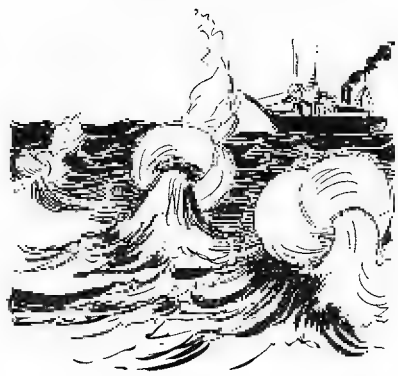
WE CAN'T

LUKE COLD: "Hey, you're sitting on some of my jokes I've just written."

LUKE WARM: "I thought I felt something funny."—*Luke Blanco.*

KNOTCHERALLY

First Prize—$3.00



FIRST NUT: "Why do they have knots on the ocean instead of miles?"

SECOND DITTO: "Well, you see, they couldn't have the ocean tide if there were no knots."—*Hymen Brush.*

ALL jokes published here are paid for at a rate of $1.00 each; $3.00 is paid for the best joke submitted each month.

Jokes must have a scientific strain and should be original.

Write each joke on a separate sheet of paper and add your name and address to each.

Unavailable material cannot be returned.

CRUSTY

MARS: "The Earth says it won't stand having its insides heated any more, it is hard enough to cool off as it is."

VENUS: "My, what a lot of crust it has."—*Irwin Stillman.*

GOOD EXCUSE

VISITOR: "What makes the loud speaker roar like that?"

RADIO NUT: "The wavetrap must have caught some of those poor 'radio waves.'"—*Irwin Stillman.*

LOOKS LIKE RAIN—

"Oh, waiter, what is this you've brought me?"

"Why, that's bean soup."

"Of course, it's been soup, but what is it now?"—*Adelaide Salvo.*

GENERALLY SPEAKING

CLIENT: "Could I see General Green?"

CLERK: "Sorry, but the General is ill today."

CLIENT: "What's the trouble?"

CLERK: "Oh, things in general!"—*Clifton Ask.*

IT WORKS TOO!

"I want to buy some good oil to lubricate the castors on the legs of my dining-room table."

"Try the drug-store on the corner, madam — they sell CASTOR OIL."—*Wm. Lemkin.*

TURNING TIME BACKWARD

QUARTZ: "I knew that 'Gravity Nullified' stuff in the last September issue of this magazine was a hoax at the first glance."

CRYSTAL: "How's that?"

QUARTZ: "I read the October issue first."—*Irwin Stillman.*

FORDING AHEAD

ED: "How is your son getting along in the Ford factory, Joe?"

JOE: "Fine, he's been promoted."

ED: "Promoted?"

JOE: "Yes, siree—he used to put on chassis nut number 34, and they jumped him right up to number 37."—*Viola Boetsch.*

FIRE'S HOT ENOUGH

"Why didn't you put that fire out with the kettle of water on the stove?"

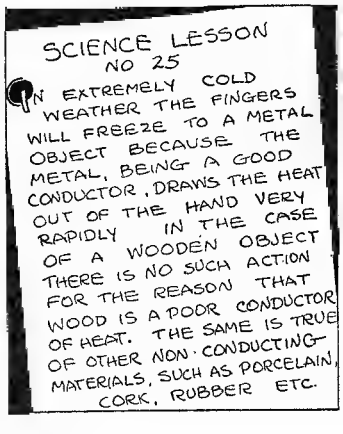
"That's no good—it's hot water!"—*Wm. Lemkin.*

ALARMING

JACK: "What made you oversleep this morning?"

JIM: "There are eight of us in the house, but the alarm was only set for seven."—*A. Kimmel.*

SCIENTY SIMON SCIENTIST


SCIENCE LESSON NO 25
IN EXTREMELY COLD WEATHER THE FINGERS WILL FREEZE TO A METAL OBJECT BECAUSE THE METAL, BEING A GOOD CONDUCTOR, DRAWS THE HEAT OUT OF THE HAND VERY RAPIDLY IN THE CASE OF A WOODEN OBJECT THERE IS NO SUCH ACTION FOR THE REASON THAT WOOD IS A POOR CONDUCTOR OF HEAT. THE SAME IS TRUE OF OTHER NON-CONDUCTING MATERIALS, SUCH AS PORCELAIN, CORK, RUBBER ETC.

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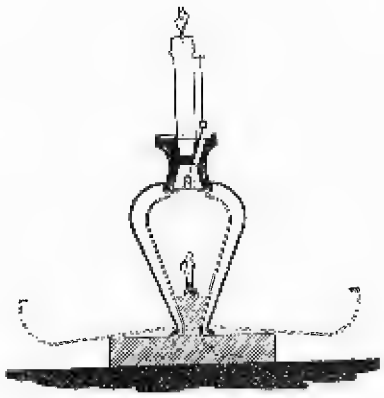
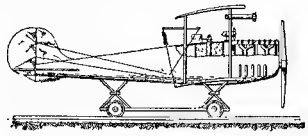
LATEST PATENTS

Favor Distributor



No. 1,676,137, issued to Wm. E. Dodge. The device shown above is a favor distributor and novelty which contains a concealed favor exposed either by manually or automatically releasing the sides of the container, which are composed of hinged or springy sections. A candle can be secured on the top, and when burned down to a certain point, may release the favor.

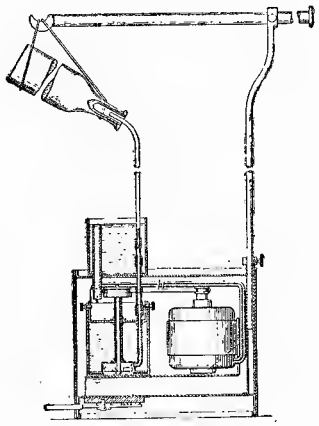
Mechanically Piloted Airplane



No. 1,670,641, issued to Lawrence B. Sperry. This invention is a controlling apparatus for a self-controlled airplane comprising a means for automatically stopping the propeller, and includes a gyroscope and a barometric device for governing the angle of descent and height of flight. It can also be applied to aerial torpedoes.

Continuously Flowing Bottle

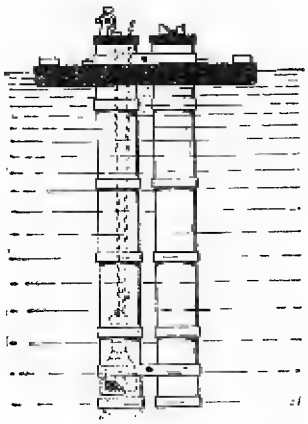
No. 1,672,910, issued to Charles W. Saalburg. The mechanism shown below comprises a reservoir, a pump, a receptacle above the reservoir, and an overflow pipe in the receptacle draining into the reservoir. A supply pipe extends from the pump to the receptacle and leads to a suspended container. The illusion produced is that the liquid is flowing continuously. Several colored streams may be dispensed without mingling.



Notice to Readers:

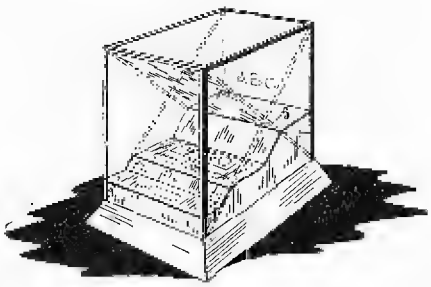
These illustrated and described devices have recently been issued patent protection but are not as yet, to our knowledge, available on the market. We regret to advise that it is impossible to supply the names and addresses of inventors of the devices to any of our readers. The only records available, and they are at the Patent Office at Washington, D. C., give only the addresses of the inventors at the time of application for a patent. Many months have elapsed since that time, and those records are necessarily inaccurate. Therefore, kindly do not request such information, as it is practically impossible to obtain up-to-date addresses.

Device for Locating Submerged Bodies



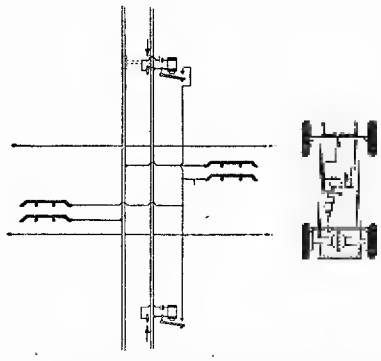
No. 1,675,965, issued to Christ G. Weinreich. In this invention, a vertically movable lamp and reflector are placed within a tubular member which may be closed on top. The light and observation tube are attached to the hull of a boat. The lower end of the reflector is provided with a removable and reversible lens and the wall of said reflector is perforated to cool the lamp. The observation tube is placed adjacent to the light tube.

Illusion Device



No. 1,680,855, issued to William Albert Burns. The object of this invention is to produce an illusion in apparatus of the phantascope type, and includes a transparent mirror which produces an image of an illuminated object. A partition of glass divides the box into two compartments. The horizontal edge of the mirror is concealed.

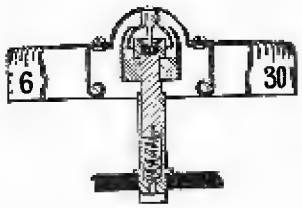
Automobile Stopping Device



No. 1,668,279, issued to Hugh Byron Lindley. The arrangement shown above comprises a pair of ramps affixed to a railroad track, with contact members placed so as to engage a motor vehicle and stop it by grounding the ignition system. A means may also be provided for applying the brake automatically. When no train is approaching, the bridge between the ramps is open.

Magnetic Compass

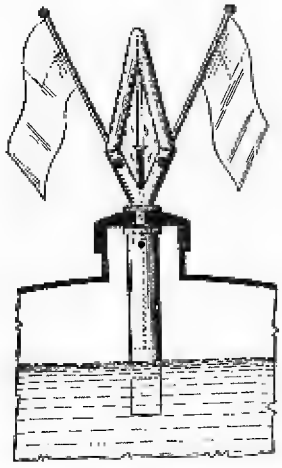
No. 1,679,764, issued to Charles H. Colvin. The device shown below is a compass of the moving card type, having the magnetic element well damped in oscillations when submerged in liquid. Through its



construction the magnetic element cannot become disassociated from the mounting post.

Liquid-Level Indicator

No. 1,679,451, issued to Lyle J. Van Duzer. The device illustrated here is a combined radiator cap and water level indicator for automobiles. A stem projects into the radiator and carries therein a rod and a float with pointer secured to the upper end of the rod. The front plate is marked in suitable indicia to show the depth of water.



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THE ORACLE

Toxic Gases

(2282) J. Matthews, White Plains, New York, writes:

Q. 1. We would like to have you settle a dispute. Is there any kind of gas which causes instantaneous unconsciousness. A say there is, B says there is not.

A. 1. In regard to the lethal effects of gases, we would advise that you will find much information on the subject in Vol. 14, "Medical Aspects of Gas Warfare," published by the War Dept., at Washington, D. C., in 1926. Many gases will cause unconsciousness immediately, if inhaled in sufficiently high concentration. It is presumed, however, that you refer to rather low concentrations. Among poisonous gases are hydrogen sulphide, hydrogen cyanide, and carbon monoxide. The toxity of hydrogen sulphide was determined by the Bureau of Mines, in connection with some studies of high sulphur petroleums. According to the British Official History of the War, Medical Service, Diseases of the War, Vol. 2, 1923, one part of hydrogen sulphide in 1,000 parts of air is immediately fatal for a man, and one part of hydrogen cyanide in 2,000 parts of air is also immediately fatal. One per cent of carbon monoxide will cause immediate unconsciousness in almost all warm-blooded animals. It, of course, is more dangerous because it is colorless, odorless, and tasteless. For more detailed information on carbon monoxide, you are referred to Public Health Bulletin 150, of the U. S. Public Health Service on "Carbon Monoxide" literature. None of these publications are now available for distribution, but you can find them in the general libraries. Another booklet, known as Bulletin 231, entitled "Investigations of Toxic Gases from Mexican and Other High Sulphur Petroleums and Products," may be of interest to you, and is obtainable from the Government Printing Office at Washington, D. C., the price being thirty cents per copy.

Chromium Plating

(2283) P. Molyneux, Lake Worth, Fla., asks:

Q. 1. Please publish the formula for a chromium plating bath and also describe briefly the procedure used in plating articles with this metal.

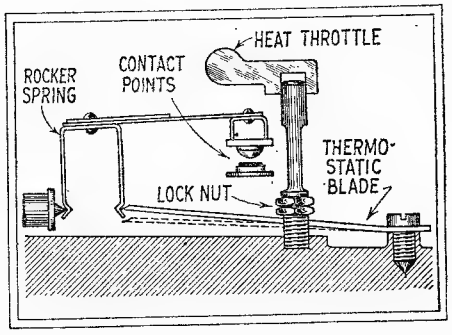
A. 1. The main disadvantage of the present chromium plating baths consists in the necessity of using metallic chromium itself as the anode. It is difficult to obtain chromium sheets or plates in a state of sufficient purity for this use. It is necessary, therefore, to use platinum, which, of course, adds greatly to the expense. Furthermore, even when chromium anodes are used, the rate of consumption must be regulated accurately if a proper deposition is required. An improved method obviates all these disadvantages by using lead as the anode in combination with a special bath. An electrolyte is used which contains a mixture of chromic acid and chromium sulphate and other suitable chromium salts, such as chlorine compounds of chromium. As an auxiliary agent, boric or carbolic acid or glycerine is used. With a solution of the character described, the lead will precipitate and will not interfere with the plating operation. In the electrolyte, the principal constituents are used according to the following per cents:

Chromic acid	5 to 10 per cent
Chromium sulphate	5 to 15 per cent
Boric acid	5 per cent

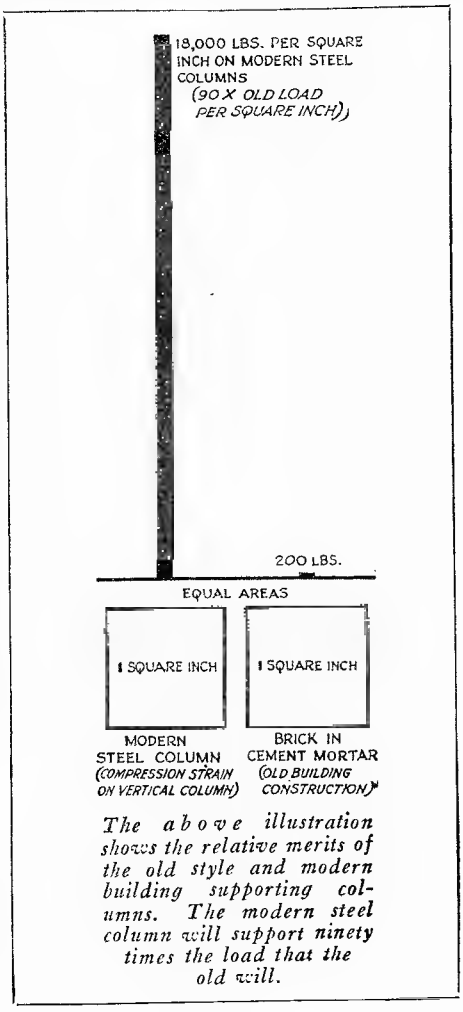
This is not the only method of plating with chromium, and for further and more detailed information we would suggest that you obtain the following United States Patents: Patent No. 1,600,076, issued to Eiji Euzuki; Patent No. 1,581,188, issued to Colin G. Fink; Patent No. 1,645,927, issued to Harrie C. Pierce.

The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink; no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 50 cents is made for each question. If the questions entail considerable research work or intricate calculations, a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.



The illustration appearing above shows how the super automatic iron works. Temperature is controlled by the heat throttle and remains constant for any setting.


18,000 LBS. PER SQUARE INCH ON MODERN STEEL COLUMNS
(90 X OLD LOAD PER SQUARE INCH))
200 LBS.
EQUAL AREAS
1 SQUARE INCH
1 SQUARE INCH
MODERN STEEL COLUMN
(COMPRESSION STRAIN ON VERTICAL COLUMN)
BRICK IN CEMENT MORTAR
(OLD BUILDING CONSTRUCTION)

The above illustration shows the relative merits of the old style and modern building supporting columns. The modern steel column will support ninety times the load that the old will.

Super Automatic Iron

(2284) S. Carnall, Hermosa Beach, Calif., asks:

Q. 1. Will you please give me some information as to how the new super-automatic iron works, and if possible, publish a drawing showing the internal construction?

A. 1. On this page you will find illustrated a cross-sectional view of the automatic iron mentioned in your letter. The heat throttle, which is a small lever on the top portion of the iron, sets the operating tempertaure. At the lower end of the throttle is a lock nut which raises and lowers a thermostatic blade. This blade extends almost the entire length of the iron and is connected with the bottom or sole plate, so that it follows the temperature of this plate at all times. When the iron heats, the thermostatic blade is bent upward, throwing the rocker spring off center. When the heat throttle is at the "high" position, the lock nut is at its lowest, which makes it necessary for the thermostatic blade to bend upward through a long distance before the rocker spring is thrown off center. When the throttle is at "low," the blade need only bend upward a short distance. To the rocker spring is attached the rocker arm, at the end of which are attached the contact points. The rocker arm is designed for a quick make-and-break wiping contact.

Building Construction

(2285) E. Burkehardt, Banesville, Ohio, asks:

Q. 1. Will you kindly compare the old and new method of constructing buildings, that is, the advantages gained with the steel column over the brick-in-cement-mortar column.

A. 1. We are illustrating on this page the weights which these columns will support for equal areas of a steel column and a brick column. The old type of column will support 200 pounds for each square inch of cross-section. The modern steel column will support 18,000 pounds per square inch, which is equal to ninety times the old load.

A Correction

(2286) J. T. Blake, Roxbury, Mass., writes:

Q. 1. In the article on ice which appeared in the June, 1928 issue, I cannot see how ice can boil (after melting) alcohol. I also think that the dissociation of water is practically negligible when the iron is in contact with the ice.

A. 1. We are indebted to Mr. Raymond B. Wailes, author of the article, for the following explanation:

You are right in asking how ice can boil (after melting) alcohol. It cannot. The first statement, that ice can cause frozen alcohol to melt, as you say, is true, but to boil it, no. My error.

Assuming the red-hot iron is near a piece of ice or drop of water and is at 750 degrees C., very little, if any, dissociation of the water will take place. But give the iron a blow as hard as you can with a hammer . . . what will the temperature be? This property of melting, or exploding red-hot iron is not new with me, for in my high school days, my forge shop instructor, in a moment of fun, produced this queer spectacle, and I have repeated it after him many times. I can see no other manner in which the iron is actually melted, and sometimes it seems that it is only blown to pieces, than to account for it by the decomposition of the water or the ice. The ice does burn, scintillating in a glorious shower of sparks and leaving little burned-out pieces of iron oxide where the drops cease rolling.

I quite agree with your statements that the dissociation of water is practically negligible when the iron is in contact with it, but when the variable pressure is also introduced, conditions are different.

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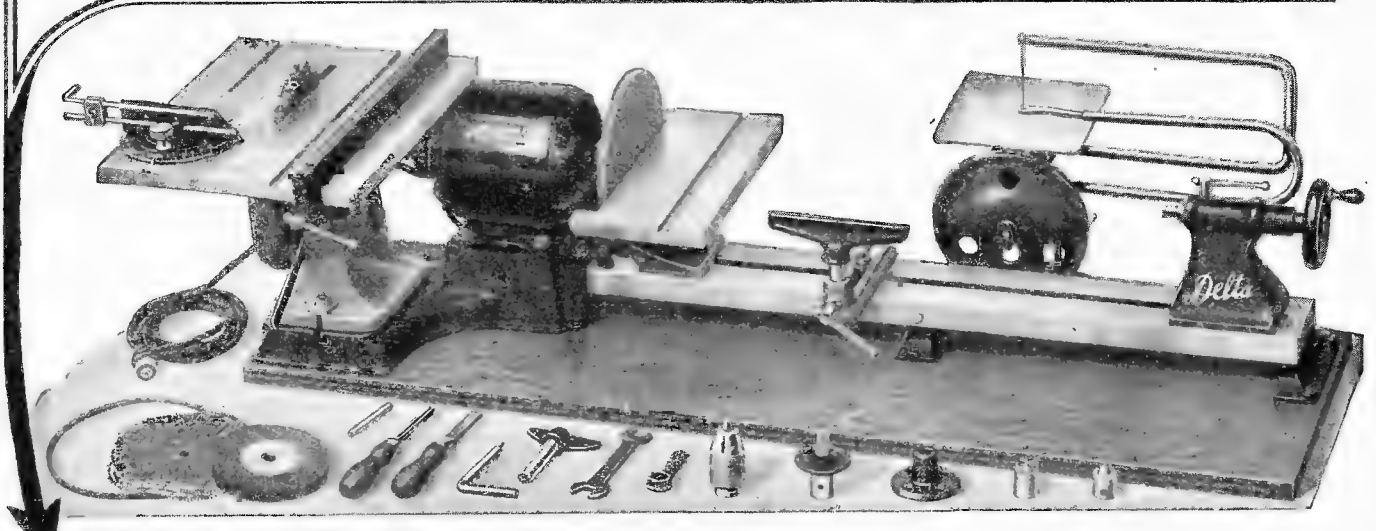
20 New Big Exclusive Features in the 1929 Model "Delta" Electric Handi-Shop



New Features of 1929 Model

found *exclusively* in the "Delta" Handi-Shop, in addition to the many regular exclusive advantages, make this shop one of the finest values in the workshop field. A few of the new improvements are:

New Delta Miter-Gauge (with many new features).
New Circular Saw Adjusting Lever.
New Delta Adjustable Rip Gauge.
Larger Circular Saw Table.
1/3 H. P. Motor.
Larger Triple Foundation Lathe Bed.
1/2 inch capacity Drill Chuck.

For full details, send coupon below.

Make the Things You Have Always Wanted to Make

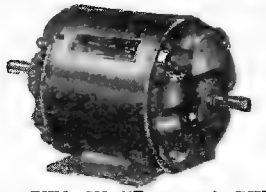
With this convenient, practical workshop. It's *so easy* and *so quick!* Save money on repair work. Earn money in your spare time. Complete instructions furnished. With each Handi-Shop is included, at no extra cost, complete set of working drawings. Below are a few of the hundreds of articles you can make in a jiffy with a Handi-Shop.

Blue Prints Included

Scores of Exclusive Advantages *in this* Big Husky Home Workshop

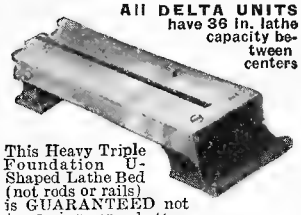
The DELTA Handi-Shop is a man-sized, motorized workshop, complete, efficient and PRACTICAL IN DESIGN! Does everything from building full-sized furniture, turning table legs, to finishing delicate detail work. Study the illustrations carefully. Note the **two-shaft motor** that permits **two** or **three** operations **at one time**—the heavy Triple Foundation U-Shaped Lathe Bed (no rods)—the *practical* arrangement of the Circular Saw that permits the cutting of large lumber without interference—the Improved Tilting Tables on the Circular Saw, Sanding Disc, and Jig Saw, with many exclusive features. Has **automatically oiled** bronze bearings and is **completely assembled** on heavy veneered wood base.

This combination of advantages, plus many more, IS FOUND EXCLUSIVELY in the DELTA HANDI-SHOP! No wonder even last year's Handi-Shop was an outstanding value. **And now, with the many additional exclusive features of the new 1929 model, this shop is in a class by itself — above all comparison — at a new price that is surprisingly low!**



This TWO-SHAFT motor is THE practical motor for the workshop. Permits you to carry on two or three important operations at one time — **without continually dismantling the set-up.**

All DELTA UNITS have 36 in. lathe capacity between centers



This Heavy Triple Foundation U-Shaped Lathe Bed (not rods or rails) is GUARANTEED not to spring or chatter.

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without obligation. See how PRACTICAL, how EFFICIENT is this sturdy, full-sized machinery under **actual working conditions.** Study its many exclusive advantages. You will find the Handi-Shop complete with all necessary equipment for **Circular Sawing, Woodturning, Jig Sawing, Sanding, Drilling, Grinding** and **Buffing.**

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Then if you decide to keep the Handi-Shop, you can have your choice of three convenient methods of payment.

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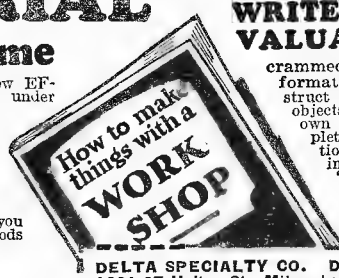
Dept. IS-1228



WRITE FOR THIS VALUABLE BOOK

crammed full of practical information on how to construct useful and decorative objects. Helpful whether you own workshop or not. Complete directions, illustrations, diagrams. Contains important information on "finishing." If you want this book, send 10c, which merely covers cost of mailing. See coupon below.

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(Check material desired)

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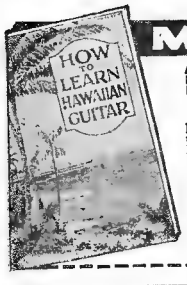

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Pump Idea That Made a Fortune

By H. Winfield Secor

(*Continued from page* 699)

he was doing before the present twenty-acre manufacturing plant came into being. At that time the site of the present plant was merely "another piece of farming country." Somewhat before this time, it is interesting to note that Mr. P. A. Myers, the subject of our interview, was born on a farm just east of Ashland, Ohio. At the age of ten years, he early felt the urge to devise various mechanical devices about the farm. He invented a number of automatic devices, including a self-closing latch for farm gates; and a most useful collar to keep horses inside a pasture. This horse collar of light weight was arranged with a band passing around the breast of the horse, so that if he tried to push against a gate and break it down, a pin would be pushed against the horse and thoroughly discourage him.

Somewhat later, Mr. Myers began observing that a great deal of time was lost in chaiging the shafts on wagons, also in changing wagons from a single to a double team rig. His inventive genius asserted itself and he devised a very simple arrangement whereby shafts could be changed on a buggy, or other wagon, by simply pulling up on the shafts and lifting them off, a single bolt with a safety spring fitted to it holding the shafts safely in place; when a pole for a team could be substituted for a pair of shafts.

Let us take a look at Mr. Myers a few years later, after he had spent about eighteen months in an academy near his home town, where he absorbed the basis elements of mathematics and mechanics, which was to help him immensely in his future career. Like many other college students, Mr. Myers ran out of funds and then he joined his brother, Francis E. Myers, who was selling agricultural machinery to the farmers in the Ohio district. The subject of our interview stresses this event as one of the turning points in his life, as during the next few years he was to encounter first-hand evidence of some of the many pumping, spraying and other problems which the farmer was beset with. So while he earned $20.00 a month and was furnishing his own horse and buggy, he was laying the ground-work for a great inventive and business future. "Without a doubt he built better than he knew"—as one philosopher has put it.

First Pump Inventions

THE first pump improvement conceived by Philip A. Myers was the result of a peculiar circumstance. He had noted that what the farmers needed badly was a hand force pump of the double acting type; one that would throw an even stream of water from a hose, in contrast to the irregular pulsating stream delivered by the single-acting hand operated force pumps then in vogue. Our inventor made a few sketches on paper and gradually worked out his idea for a double acting force pump, and he tried out the invention in the cellar under the combination office and store that he and his brother maintained as their business headquarters. Looking back to those days, Mr. Myers stated that it was amusing to recollect that in view of the fact that he was being employed as a pump salesman by his brother, he was afraid of being "called down" by him when he discovered that he was *wasting time* monkeying around with a new pump contraption! What did he know about designing pumps? He had enough to do to sell the line of machinery they were already representing.

Portable spraying equipment of the type here illustrated was used in large quantities for the treatment of swamps and other grounds in the Panama Canal Zone, to eliminate mosquitoes. Mr. Myers has made many inventions in the line of spraying equipment.

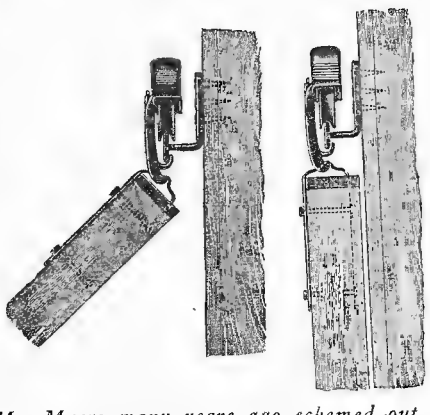
But the true born inventor has a pretty strong conscience that he was put on earth to do a certain piece of work, and in a few words, the new double-acting pump became one of the successful stepping stones on which the large present-day business, previously described, slowly but surely advanced. One of the next pump problems that Mr. Myers tackled involved a new design of tubular deep well pump. At that time the tubular well was just coming into prominence and a brand new pump was necessary, one that could lift water from a great depth.

Glass Valve Seat Invented

ANYONE who has ever had experience with pumps, especially those about the farm or suburban houses, knows that metal valve seats, whether of brass or iron, tend to corrode or rust. If they do not rust they tend to accumulate a vitreous substance which hardens the leathers and causes the pump to lose priming. Mr. Myers gave considerable thought to the troubles of those who had to rely on pumps for their water supply, and after trying many different metals and alloys, one day he conceived the idea—why not use glass?

To anyone not having the persistence and the vision of a born inventor, the idea of

(*Continued on page* 742)



Mr. Myers many years ago schemed out a way to prevent sliding barn doors from being broken by the wind. He perfected a pivoted support of the type shown, which allows the door to swing outward, in the event of a strong wind.

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Celebrating its 9th successful year, America's big, old, reliable Radio Corporation springs a genuine sensation in high-grade sets. With its latest, Super-powered, 1-dial Miracos—the All Electric wholly self-contained, hum-free, AC-8 and AC-9, using AC tubes or the new 8-tube models for batteries or Eliminators—you are guaranteed values and savings unsurpassed in the fine set field.

Compare a Miraco with highest-priced radios, for 30 days in your home. Surprise and entertain your friends—get *their* opinions. Unless 100% delighted, *don't buy it!* Return everything—*the complete outfit*—at our expense. Your decision is final—absolutely!

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With its rich, clear Cathedral tone, hum-free operation, tremendous "kick" on distant stations and razor-edge selectivity—with its costly sturdy construction, latest features, including phonograph pick-up connection, ease of tuning, beauty, and economy — a Miraco will make you the envy of many whose radios cost 2 to 3 times as much!

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Everything reaches you splendidly packed and rigidly tested to insure your instant enthusiasm. Enjoy the outfit 30 days—then decide. Liberal 3-year guarantee on each set. Play safe, save lots of money, and insure satisfaction by dealing direct with Radio's old, reliable builders of fine sets—9th successful year.

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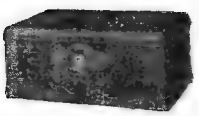

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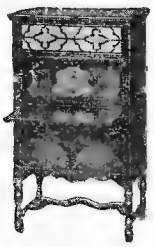
Richly designed, genuine walnut console of finest type. Electro-dynamic or magnetic power cone, or long air column speaker. Marvelous value.



A popular walnut Hi-Boy Console, with drop-leaf desk. Beautiful two-tone finish. Rare bargain!

Beautifully graceful Spinet console, genuine two-tone walnut. Choice of speakers. Also comes in Electric Phonograph-Radio Combination.

A new-type arm-chair console. Genuine walnut. Very pretty. Low priced. Electro Dynamic or Magnetic Power Speakers.

At right, a Lo-Boy console, walnut finish, that costslittle. A gem!

Above, popular inexpensive combination. Set on Table Speaker (sold separately).

Metal or wood compact style cabinets. Wood cabinets in walnut or new shaded silverchrome finishes. Cathedral Electro-Dynamic or Magnetic-Power Speaker to match!

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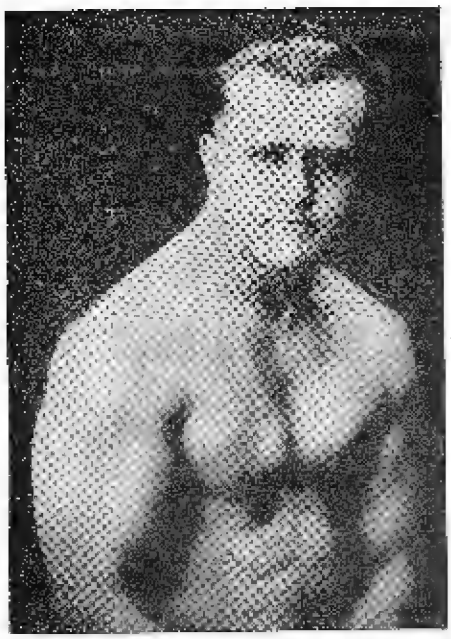

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Kill This Man!

There's a devil inside of you. He's trying to kill you. Look out for him! He tells you not to work so hard. What's the use—the boss only piles more work on you. Do you recognize him? Of course you do. He's in us all. He's a murderer of ambition. He's a liar and a fool. *Kill Him!* If you don't, he will kill you.

Saved

Thank your lucky stars you have another man inside of you. He's the human dynamo. He fills you full of pep and ambition. He keeps you alive—on fire. He urges you on in your daily tasks. He makes you crave for life and strength. He teaches you that the weak fall by the wayside, but the strong succeed. He shows you that exercise builds live tissue live tissue is muscle—muscle means strength—strength is power. Power brings success! That's what you want, and gosh darn your old hide, you're going to get it.

Which Man Will It Be

It's up to you—Set your own future. You want to be the Human Dynamo? Fine! Well, let's get busy. That's where I come in. That's my job. Here's what I'll do for you.

In just 30 days I'll increase your arm one full inch with real live, animated muscle. Yes, and I'll add two inches to your chest in the same time. Pretty good, eh? That's nothing. Now come the works. I'll build up your shoulders. I'll deepen your chest. I'll strengthen your whole body. I'll give you arms and legs like pillars. I'll literally pack muscles up and down your back. Meanwhile, I'll work on those inner muscles surrounding your vital organs. You'll feel the thrill of life shooting up your old backbone and throughout your entire system. You'll feel so full of life you will shout to the world, "I'm a man and I can prove it."

Sounds good, what? But listen! That isn't all. I'm not just promising these things. I guarantee them! It's a sure bet. Oh, boy! Let's ride.

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Pump Idea that Made a Fortune

(*Continued from page 740*)

putting a glass valve seat into a metal pump would have seemed the height of folly. As shown in one of the accompanying pictures, however, the glass valve seat has proved to be one of the greatest as well as novel features of the pumps built by Mr. Myers' concern, and ample protection is afforded the glass valve seats by mounting them between rubber gaskets. As the illustration shows, a brass cage, one of the supporting legs of which is broken away in front to make the picture clearer, is screwed down onto a rubber gasket, and between this upper resilient ring and a second lower rubber ring, we find the glass valve seat. The glass valve members are produced from a high quality, specially seasoned glass, the seat surface being polished until it is smooth and true on a remarkable machine designed by Mr. Myers. The perfect valve has a special rubber face which pushes downward against the glass valve seat when it is closed. On the up stroke of the pump, the poppet valve with its rubber face rises upward inside its brass retaining cage. As the pump stroke is reversed to a down movement, the poppet valve immediately falls on the glass seat and closes the chamber tightly.

Invents Gear Pump Handle

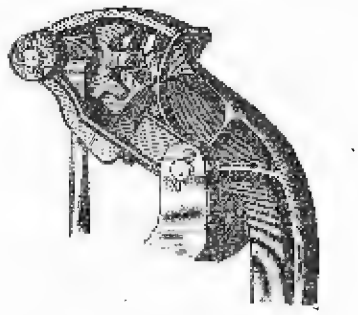
IN his travels about the farming district Mr. Myers noted that considerable labor was expended in working the pump handle up and down in order to keep a steady stream of water issuing from the pump or from a hose connected to it. Again the inventive streak in our inventor's mind asserted itself, and he became imbued with the idea that there must be a way to lessen the labor of operating these hand pumps. After trying a number of different schemes Mr. Myers finally devised a rolling cog gear arrangement, which is illustrated in one of the pictures herewith. This invention was soon put into practical use on the new pumps manufactured, and it was found by

There are many uses for portable compressed air sprayers of the type here shown, and many features about which were worked out by Mr. Myers. It was a long time before these portable sprayers were commonly sold, but now they are widely used for spraying plants, to protect them from insects; for whitewashing etc.

actual measurement with scales, that whereas a plain lever handle on the pump required fifteen pounds pressure, to raise 110 pounds of water, that the newly invented cog gear lever enabled the operator to raise 110 pounds of water with only ten pounds pressure exerted downward on the handle. This represented a gain in labor of 33 1/3 per cent.

Invents Self-Oiling Pump

AS the pump manufacturing business started to grow and the company got into the field of engine and electric motor-driven pumps for the larger farms and suburban home water supply, one of the outstanding problems which presented itself was the correct and frequent oiling of the pump parts. As in the case today with the majority perhaps of privately owned automobiles, the owner fails to lubricate the various bearings and other friction points



One of the very ingenious pump inventions made by Mr. Myers is that illustrated above—it comprises a gear drive which couples the pump handle with the lift rod. By this simple mechanical innovation, the inventor was able to increase the efficiency of any pump 33-1/3 per cent.

about the chassis, and a few of the progressive car manufacturers have therefore, fitted the chassis with a one shot lubricating system operated by a pedal at the driver's seat. Recently one car has been brought out with a self-lubricating chassis.

Mr. Myers was one jump ahead of this manufacturer, but in a different field of course, and for a long time now the trials and tribulations of the farmers and others using motor-driven water pumps have been obliterated by the genius of this inventor, who placed all of the moving pump parts inside a single housing, partly filled with oil. As the revolving and oscillating parts of the pump members went through their hourly and sometimes all-day motions, they were constantly bathed in lubricating oil. This took away the squeaks and obviated worn parts which called for frequent replacement. It would require a good sized book of course to describe and illustrate the hundreds of mechanical improvements and also new inventions in this interesting line of pump and farm machinery devices worked out by Mr. Myers.

Other Inventions Than Pumps

THE prolific pump inventor had other ideas in his mind besides those concerning pumps, as the writer's interview with him soon disclosed. One of his interesting basic inventions was that of a hinged barn door hanger, a picture of which is shown herewith. It seems that one of the troubles farmers used to be bothered with frequently was that where barn doors were blown off by wind storms. Also if the barn wall bulged or became warped out of shape, the ordinary sliding barn door refused to move. Mr. Myers overcame all these troubles by means of his flexible or hinged door hanger. A simple idea, but worth a great deal to the farmer and a strong seller today.

Hay Unloaders

IT may seem that there was not much to invent along the line of hay unloading machinery, but where one meets with large farms of hundreds and thousands of acres, the gathering of the hay and storing it in the barns is a man sized job. Many of Mr. Myers studies have been on the problem of improved hay-unloading machinery.

One of the accompanying pictures shows

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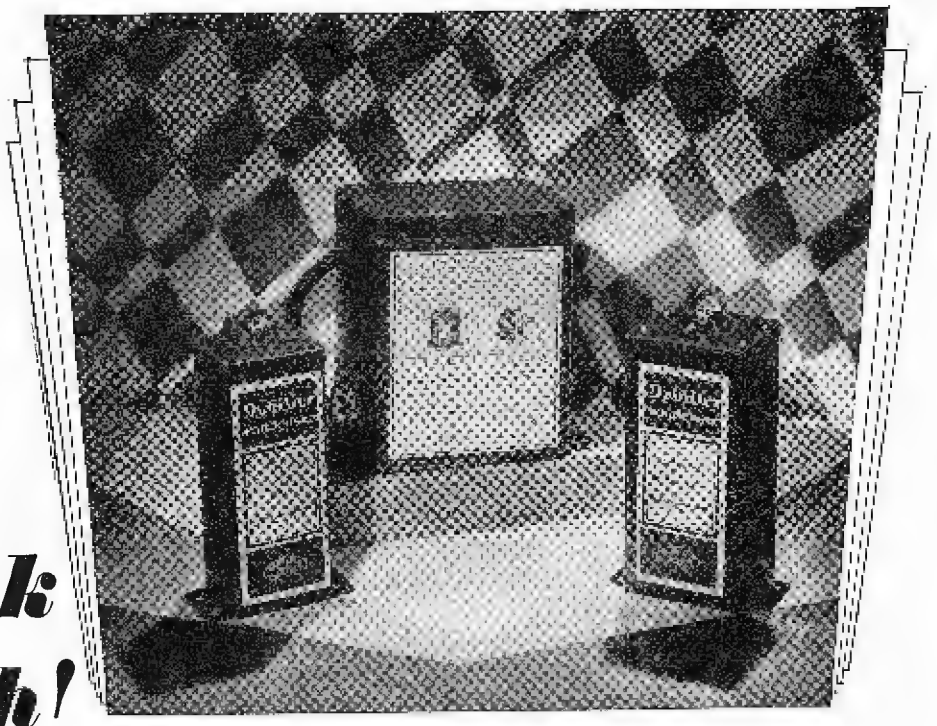

cr-r-rack
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These scientifically designed interference eliminators will make your set operate as quietly as with batteries.

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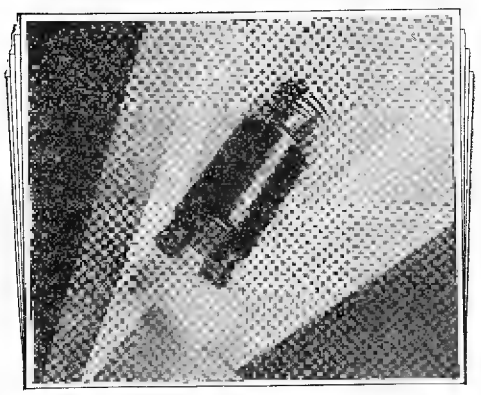

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DON'T YOU, like everyone else, want all the fun, profit and popularity you can get out of life? Where will you find more *fun* than in being able to create your own music? Or more *profit* than in being able to make $5 to $25, a night for work that is "play"? Or more *popularity* than in being able to "dash off" a snappy fox trot, a dreamy waltz or stirring march on your xylorimba?

Joy and Pleasure Ahead

Imagine long, cheery evenings at home or with sweetheart, wife or friends. Picture yourself the center of interest wherever you go—looked up to as the fellow or girl who plays the xylorimba. A whole *lifetime* of musical joy and all that it means. Don't these thoughts appeal? You can make them come true!

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Remarkable tho the Xylorimba is, *it is the easiest of all instruments to play.* No tiresome practice. No teacher. No finger or lip exercises. You begin to play *at once.* Soon you amaze friends and relatives with expert xylorimba selections. Xylorimbists are always in demand at dances, parties, theatres and radio studios—and well paid for the entertainment they furnish. As a xylorimbist, you are always able to make substantial spare-time money.

Plays 20 Minutes; Gets $20

Ralph Smith, Chicago, played 20 minutes at a wedding; his pay was $20.00. Although only twelve, Turk McBee, Jr., plays big-time vaudeville exclusively. Harry Breuer, New York, has made thousands of friends through his xylorimba selections on the radio. L. E. Hallman, Reading, Pa., writes: "Made $300 in five weeks—spare time."

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Pump Idea that Made a Fortune

(*Continued from page* 742)

one of the many different types of hay unloaders devised by Mr. Myers. A team of horses or a motor truck or some other source of power, such as an electric motor or gasoline engine, raises the hay from the wagon and with a pull on a control rope, the hay is pulled along over the mow, and then by pulling on a trip line, the load of hay, weighing several hundred pounds, is dropped in the mow and exactly at the point desired. Some of the devices perfected in the haying machinery line comprise improved slings to be placed in the hay load as it is built up on the wagon. When the wagon load of hay reaches the barn, it is a simple matter to get hold of the ends of these slings and couple them together, so that the hoisting rope in this way can lift a large bundle of hay weighing several hundred pounds or more. In other words, a large load of hay can be unloaded in this way with the aid of Mr. Myers' cross draft unloader here illustrated.

Inventor's Spray Pump Helped Build Panama Canal

WHEN Uncle Sam started to build the Panama Canal, one of the greatest problems that his scientists and engineers encountered was the elimination of the mosquito to the greatest extent possible. Hundreds of the knapsack spray pumps illustrated in one of the accompanying pictures and devised by Mr. Myers were purchased by the canal engineers. Here again the pump idea is prominent, and another mechanical problem took the form of an improved spray nozzle.

Mr. Myers' company manufactures sprayers of every conceivable description, a veritable host of them, and one of their interesting applications of a compressed air sprayer, Mr. Myers stated, was its use in removing old wall paper. Where a wall had several layers of wall paper on it, the easiest way to remove this without in any way injuring the plaster underneath, is without a doubt the method suggested by our inventor. To do this job he fills the compressed air sprayer two-thirds full of hot water, and the pump handle is then worked up and down until a pressure of fifty pounds in the container has been obtained. The wall paper to be removed is repeatedly sprayed with hot water, soaking the old paper with all the water it will hold, but not enough to cause the water to run down the wall. The use for the various types of pump and compressed air sprayers is rapidly extending.

Mr. Myers is actively engaged in the management of his firm today, but regularly finds time to invent or suggest improvements in new devices of interest to his company. He is a director on the boards of many of the leading industries of the country and proves the point that a successful inventor may indeed be a successful business man, contrary to the usual time-worn dictum that inventors are poor business men.

Motor Hints

Conducted by George A. Luers

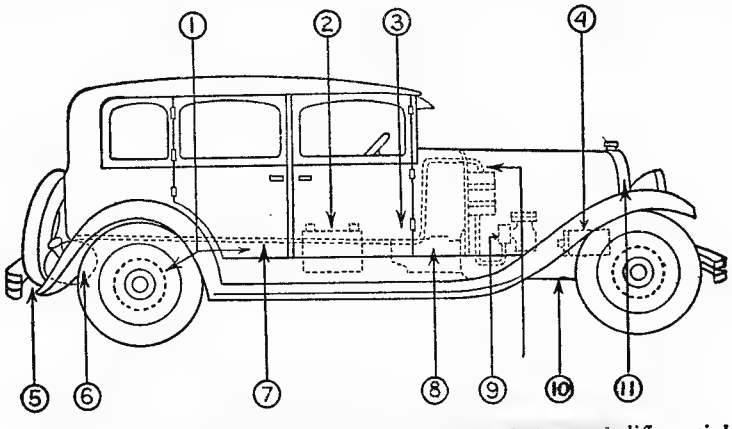
(*Continued from page* 710)

(C) Each length of wire should be inspected for worn or chafed sections particularly where the wire leads through the frame of body. If not convenient to renew the wire, protect the chafed spots against shorting my wrapping them with tire tape. Loose wires, which swing, should be taped against some support, as a moving wire will sooner or later break.

(D) Because of the frequent starts, increased use of lights and electric windshield wiper, more current is required in winter. The charging rate of the generator should be increased to around sixteen amperes. Practically every generator is fitted with a movable or third brush, to adjust the output. Moving this brush in the direction in which the armature rotates, increases the output.

(E) Remove the plug from the bottom of the gasoline tank and draw out the ac-

(*Continued on page* 746)



In the above illustration: 1, *indicates that transmission and differential lubricant should be replaced with fluid gear oil;* 2, *body terminals should be cleaned;* 3, *wiring should be repaired;* 4, *charging rate of generator increased* 50 *per cent;* 5, *springs should be greased;* 6, *sediment drained from gas tank;* 7, *gas line cleared with compressed air;* 8, *distributor adjusted and spark gaps cleaned and adjusted;* 9, *clear strainers in vacuum tank and carburetor;* 10, *flush out engine oil;* 11, *flush cooling system and fill with anti-freeze compound.*

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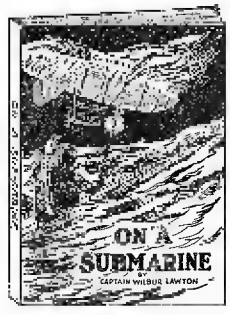

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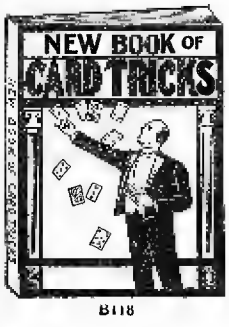

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Motor Hints

(*Continued from page* 744)

cumulated water and sediment. It is advisable in doing this to drain out all the gasoline, rocking the car from side to side, to flush off the sediment.

(F) Disconnect the gas line from the main tank to the vacuum tank, at both ends. Use a tire pump or the hose from a compressed air tank to blow the line clear.

(G) Drain off the water and sediment from the vacuum tank and the carburetor. Remove the strainers from the vacuum tank and carburetor and wash these with a small bristle brush until the mesh is clear.

(H) Flush out the cooling system, using a pound of household washing soda in hot water to clean out the sludge. Examine the upper radiator hose connection particularly. If the rubber is broken, renew this hose. Tighten all joints and hose clips to avoid anti-freeze leaking out. The radiator is then ready for filling. An anti-freeze mixture that will protect down to zero, without freezing can be made in the following proportions: One quart alcohol, one quart glycerine and five quarts of water. The entire quantity can only be determined by measuring the contents of the cooling system, unless it is contained in the instruction book for the car. The glycerine mixture is recommended for reason that this mixture has a higher boiling point than an alcohol and water mixture. In replacing loss due to boiling over, only alcohol should be added.

(I) Use penetrating oil on the springs after cleaning and follow with engine oil applied with a brush. This is the easiest means to lubricate the springs. Lumpy and frozen roads require much spring action. The lubricated spring will not break nearly as readily as a spring rusted and stiff.

(J) Adjust the gap at the breaker points of the distributor, filing if needed to make the ends meet square and making the gap ".015" to ".018," which is the usual instruction. Remove and thoroughly clean the spark plugs, setting the gaps ".025." If the same plugs have been used for twelve or fifteen thousand miles, it is most advisable to change them. Plugs used this distance are usually prone to get dirty.

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Glow Lamp Has Radio Uses

(*Continued from page 733*)

defective windings by connecting a glow lamp in series with a source of voltage and the transformer winding as illustrated. The fact that one of these lamps takes only 40 milliamperes of current at 110 volts from an alternating current line enables them to be used for all high resistance testing. At least 150 volts direct current is needed to cause the lamp to glow. Resistor dividers in "B" eliminators and power packs can be tested with the lamp for approximate voltage in lieu of using an expensive meter, which many do not own. The lamp is connected across the "B" negative and the various eliminator taps and will glow providing that the eliminator is functioning properly and the voltage delivered at the tap under test is at least 150 volts direct current.

In the same manner the lamp can be used as an indicator and panel light, by placing it on the front of the cabinet or console where it will glow whenever the set is in use. The lamp socket, which is standard size, can be supported by a metal bracket as shown in the illustration of a suggested installation of this nature.

By connecting the lamp on 150 to 220 volts direct current, it may be made to flash periodically by placing a condenser across and a resistor in series with the line as shown. A change in either the resistance of the resistor or the capacity of the condenser will change the period of the flash. Thus, by making either the resistor or the capacity fixed, the rating of the other may be calculated by comparing the flash period with a curve previously drawn, using known constants. This small lamp also makes a handy test lamp and since it has no filament and cannot burn out, may be used for determining whether a line is supplied with 110 or 220 volts. The brilliancy of the glow will be twice as bright on the higher voltage. By its flicker, the glow lamp will identify 60 or 30 cycle alternating current and can be used in testing for A.C. or D.C. Both sides of the electrode glow on alternating current voltages of 110 volts or over and only one side lights up on D.C. voltages above 150. As it has the property of being rapidly flashed, it can be used in television work either alone where a rather small image is satisfactory or two or three of the lamps can be placed, one back of the other, so that when they glow a larger unbroken surface is presented to the eye. The lamps should be arranged so that the glow of one cathode slightly overlaps the glow of the next. For testing the oscillator in superheterodynes to determine if it is working properly, a simple wavemeter can be constructed with a coil, condenser and lamp connected as shown. This should tune to the oscillator wavelength, and when the coil of the tester is placed near the oscillator coil, the lamp will glow if the oscillator is functioning.

In high frequency work, it may be used to determine the efficiency and zero points in radio frequency choke coils. By bringing it near the input and then near the output side of the choke, the lamp will glow at the input end only if the choke is efficient and great enough power is being used. Similarly by moving the lamp up and down the axis of transmitting inductances, it will indicate the nodes and loops by lighting at the points of maximum voltage and minimum amperage. In wavemeters, the lamp forms a sensitive resonance indicator. *Name of manufacturer furnished upon request.*

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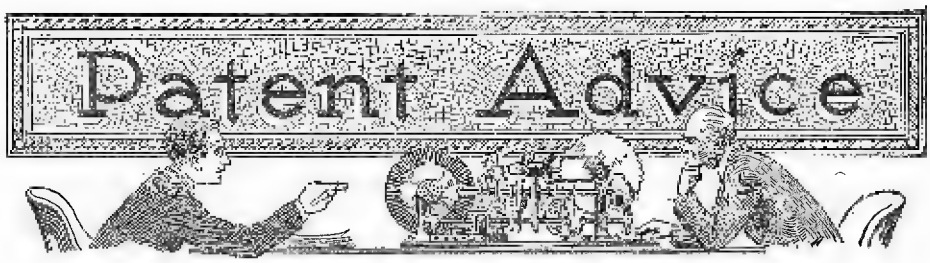

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Airless Tires

(1138) W.E. Barnes, Nome, Texas, requests our advice of a system for putting sponge rubber into tires instead of the usual tube of air. He also wants an opinion of a system for locking a tire on a wheel.

A. 1. The idea of sponge rubber for tubes has been tried out and pretty well covered by patents. Most of the sponge rubber for automobile tires has heretofore been in the form of blocks or balls. Unfortunately, the tires filled with such a product do not ride as comfortably as they would if they were filled with air, pneumatic tires being by far the best.

Your method for locking the tire on the wheel would seem to work, but we can see no advantage in this or in protecting it, unless your system is adopted. Finding no chance for such an adaptation, we advise no further action.

Unpatented Invention

(1139) Louis Lipschitz, New Richmond, Wis., has an advertising device he wishes to dispose of without patenting same, and asks what he should do.

A. 1. As a general rule, it is difficult to sell an idea drawn up on paper. Manufacturers are loathe to undertake any sort of an action with an inventor whose suggestion is not patented, the reason being that the manufacturers are not sure of a basic patent claim; secondly, they may receive the idea from the inventor, who has lauded it very highly, only to find it impractical or not suitable for their use, and having signed an agreement (probably a blind one) they would have to live up to it. We believe that you will experience considerable difficulty in placing your suggestion in the hands of those who are likely to make use of the same. We suggest you take up the matter with those who would most likely be interested. If it is a sign improvement, look to the largest manufacturers in that field, etc.

Microphone

(1140) Earl E. Williams, Baton Rouge, La., asks our opinion of a new microphone which he claims is 75 per cent more efficient than present ones. He asks our advice.

A. 1. The idea for a telephone improvement which you have designed might be quite satisfactory and it would probably be a good idea to get a patent on the same, if it does the things you claim for it, and if a broad and basic patent can be secured.

Unfortunately, your communication merely tells about the results and says but little of the nature of the tests, or any changes in current which may have taken place in effecting this test.

We regret, therefore, our inability to comment more satisfactorily on this particular article.

Theft Prevention

(1141) R. Mars, Sapulpa, Okla., makes several suggestions, one of which is for a burglar alarm and another for theft-proof auto signal.

A. 1. The suggestion which you have advanced for a burglar alarm system, using switchboard signals and the like, is by no means new. If you visit any of the modern protective agencies, you will find that not only do they use lights, but the systems are replete with relays, so as to instantly detect a short-circuit or an open circuit, by flashing a light and even ringing an alarm bell.

The second suggestion for a burglar-proof or a theft-proof alarm for automobiles is by no means new, either. Many experimenters have tried this particular effect, but it is impractical. While a particular style may be good for one car, if the same method is placed on all of the cars of that make, the thief can easily circumvent it before he even enters said car.

Automatic Airplane Control.

(1142) Jim Terry, Chicago, Ill., claims to have designed an automatic airplane control, which will relieve the pilot of practically any duties other than to see that the airplane is taken off properly, headed in the right direction, and then brought to earth again. He asks what he should do with his invention.

A. 1. The only thing that you can do with your particular system would be to try to patent it, and we advise, of course, that if you decide to do so, you place the materials in the hands of a regular patent attorney and let him cover the assignment for you. The next best move would be to try and sell the system to some recognized aircraft corporation.

You have given nothing in your letter which would enable us to base an opinion on the method involved or designed by you, and consequently we are not prepared to comment more fully.

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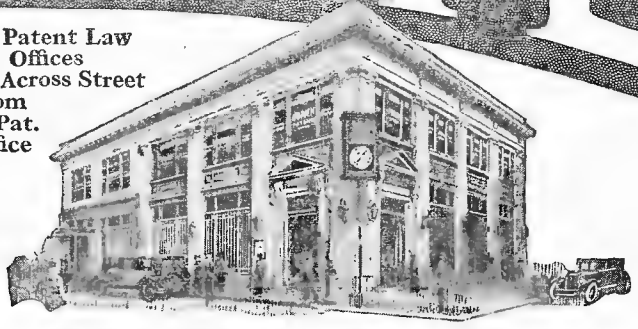

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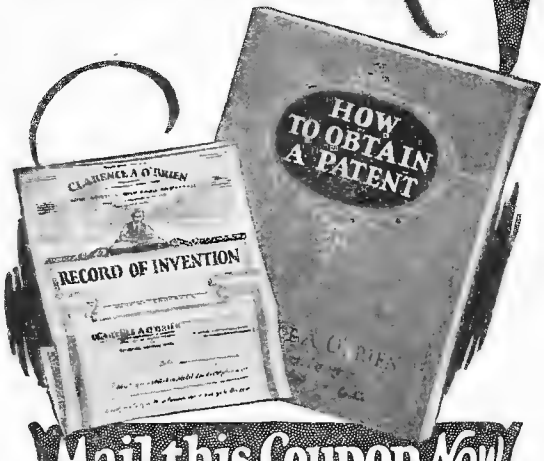

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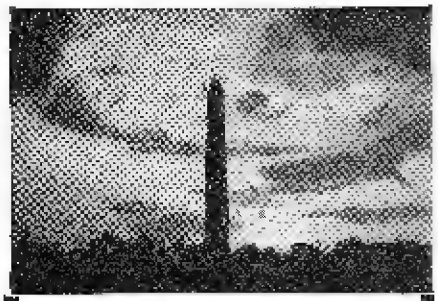

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Cities of Tomorrow

By Dr. Lee de Forest

(*Continued from page* 686)

containing a segment connection for each cell, to the radio transmitting set, or else to the wire transmission circuit, if the image is to be transmitted over a metallic circuit instead of through the ether.

The new Jenkins receiving element for television, as Dr. de Forest mentioned, comprises a double grid comprising about 2,300 small lamps, each lamp connected successively to the television circuit by means of a revolving commutator similar to that used in the transmitter. Dr. de Forest stated that he thought that the new Moore neon crater tube, used in conjunction with the revolving lens disc of Jenkins' design, was the best present solution of the television receiver problem.

The writer then asked another question which is greatly agitating the minds of those interested in the future commercial development of television; namely, what is the outlook for an early solution of the problem of how to transmit simultaneously the television image, as well as the voice, without using two different wavelengths for the purpose.

Dr. de Forest answered this query by saying that of course one way would be to transmit the television image on one wavelength and the voice on another; also that the dual transmission of image and voice could be carried on very easily by the double modulation of the carrier wave. The Bell Telephone Laboratories demonstrated this method of accomplishing the result desired about one and one-half years ago, and even triply modulating the carrier wave so that the third modulating current carried the synchronizing signals, as Dr. de Forest pointed out.

At the receiving station, under such conditions, a single antenna is used to pick up the carrier wave and by means of suitable tuned band pass filters, each signal corresponding to television image, voice and synchronizing current if desired, would be selected and passed through suitable vacuum tube amplifiers respectively to the picture reproducer, the loud speaker and the synchronizing motor or other element.

Asked if he thought that radio waves would be the medium over which practically all of the television transmission would take place during the next 25 to 50 years or more, Dr. de Forest favored the transmission of television over wire systems, with less freedom from static and induction currents, which would tend to distort or spoil the picture in many instances. With the proper choice of frequencies, it was pointed out, the wire system seemed to have many advantages over the radio means of transmission, and for one thing, the wire system would free the television broadcaster from worrying about the Federal Radio Commission.

ON the subject of aircraft, Dr. de Forest is not much of a believer in the dirigible. "It is too vulnerable," he said, "although of course, with luck, the new German lighter-than-air craft has arrived on this side of the ocean. The *Los Angeles* is still in service and she will continue to do duty as long as the elements are kind to her, and so long as the Navy's aviation experts take good care of her."

Dr. de Forest believes that the heavier-than-air craft, or airplane, will be the logical survivor in the years to come. Cheaper and more efficient fuels will be discovered, or perfected by chemical methods, and unlike many dreamers of what the science of the future will give us, Dr. de Forest does not have any faith in the radio transmission of power to aircraft. "The radio transmission of power is the most inefficient means of sending energy over a given dis-

(*Continued on page* 772)

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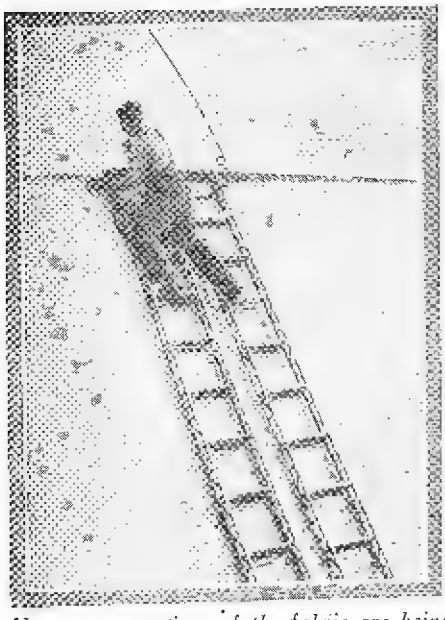
Graf Zeppelin Arrives

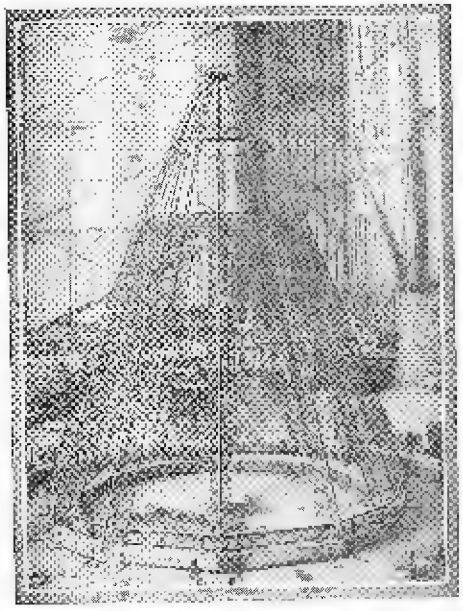
By Dr. A. Gradenwitz

(Continued from page 690)



Above—two sections of the fabric are being joined together. Note the special ladders used in this work.

of circular transverse frames held apart by girders. The rectangular panels which are thus formed are braced diagonally with steel wires. All the girders in the ship are practically straight, except those at the nose and at the tail. The gas bags are fitted in the chambers formed by the transverse wiring of each pair of main frames. It is necessary to build fins at the tail of the ship to insure longitudinal stability. These fins also act as a support for the rudders and elevators. Fire hazard, which was always present when hydrogen was used as a lifting medium, has now been eliminated through the use of helium, which is the next to the lightest gas known, hydrogen being the lightest. In modern dirigibles, as well as in airplanes, wind-driven generators are used for obtaining electric power. These are mounted in an out-of-the-way place, and each have a single-bladed propeller which rotates as the ship goes forward.



A section of the metal frame used as the tail of the ship appears above.

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Television Receiver Hints

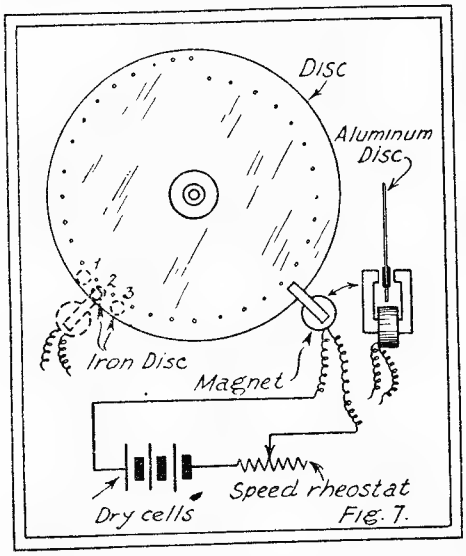
By Henry Townsend

(*Continued from page 729*)

very thin type discs only are to be employed.

A very good all around motor for the television experimenter is one of those known as the universal 110-volt A.C. or D.C., which usually comprises a series connected motor, that is one in which the field winding and the armature are connected in series. This style of motor has a fairly high starting torque even on A.C. and regulates very nicely when an adjustable rheostat is placed in series with the motor, as shown in Fig. 6. Note interference eliminator, comprising two ½ m.f. condensers, connected across motor, and center connection grounded.

It will frequently be found that, due to a reversal of the image, the direction of rotation of the motor will have to be reversed. If the motor is of the direct current type, then either the terminals of the field windings or else the armature brush leads will have to be reversed, with respect to one another. If the motor is of the single-phase



The diagram above shows one method which has been found quite successful in experimental researches by Geloso, for controlling the speed and synchronism of television discs. As the current through the brake magnet at the right is increased, the drag on the disc increases and reduces the speed. Synchronizing magnet is shown at left.

alternating current type, then the terminals of the starting winding will have to be reversed, in order to change the direction of rotation of the motor. If you happen to be using one of the A.C. induction motors having copper shading plates on the stator poles, then in order to reverse the direction of rotation, the shading plates will have to be removed and placed on the opposite pole tips; or else the stator winding must be reversed in the frame. In some cases the shaft may be loosened and slid out of the other end of the motor and the motor turned around. In other cases, it may be possible to remove the stator winding and laminated core and reverse it in the motor frame. If a small polyphase motor, such as a two-phase or three-phase type is used, then the direction of rotation will be accomplished by reversing the leads to any one phase.

Speed Control

THERE are two general methods of controlling the speed of a television disc

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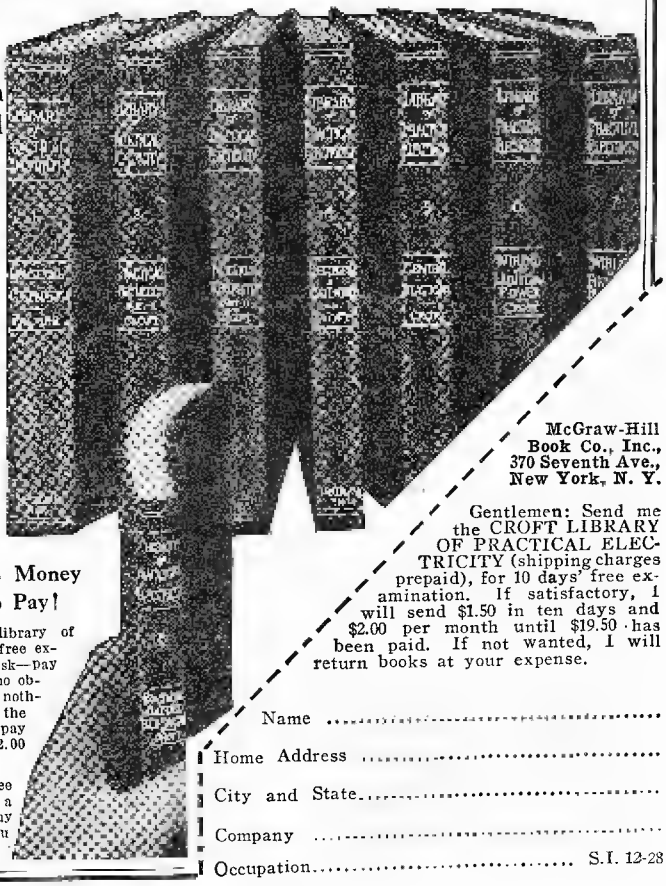

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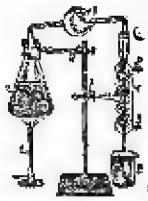

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motor; the first is the electrical method, such as by inserting a resistance in series with the motor; and the second method is that involving belt, chain gear or friction drives. By the electrical method of speed control, such as shown at Fig. 6, a power Clarostat or similar heavy duty variable resistance is used, to roughly regulate the speed of the motor to the desired value. In series with the motor also there is placed a smaller (10 to 50 ohm) resistance, usually of the variable type, which is arranged with a short-circuiting switch or push-button.

In using this control, the speed of the motor is regulated by checking with a machinists' speed-counter, or else with a tachometer, or still again by checking with the television image if it is observed in the window. This coarse regulation of the speed should be made to a point a little higher than the disc speed desired. Then the vernier resistance, say of ten to fifteen ohms, is varied, until the speed is a little below the desired disc speed; thus the motor can be momentarily and periodically speeded up by pushing the short-circuiting button across the low resistance coil. With a little practise the disc can be kept at a constant speed. The larger resistance unit of the variable type should have about 100 ohms maximum resistance for controlling a ⅛ horsepower motor, and about 150 ohms maximum resistance for controlling a 1/16 horsepower motor.

Variable resistances can be used for controlling both A.C. and D.C. motors, but in the case of the A.C. machines it is the most economical and the more efficient method to vary the speed by using an adjustable impedance or choke coil provided with a sliding laminated iron core, connected in series with the motor. Data for building such an adjustable impedance and sliding core is given in Television Magazine, Volume 1, No. 2, now available.

Many television experimenters have used the method shown at Fig. 6-B, whereby a battery motor is used from a sufficiently large storage battery of the six-volt or other type, depending upon the rating of the motor. By this method, providing a sufficiently large battery or number of batteries in parallel are used, so as to maintain a fairly even voltage, the motor speed is accurately controlled by a variable resistance placed in series with the motor, as here indicated.

In the diagram, Fig. 7, an electrical method of regulating the speed, devised by Geloso, television expert for WRNY, is illustrated. Here a small battery comprising say, a few dry cells and an ordinary rheostat, are connected with a small electro-magnet having a laminated iron core. The aluminum disc rotates between the jaws of the magnet core, and due to the eddy currents set up in the disc, a magnetic drag is set up between the magnet and the disc. The more current you pass through the magnet, the greater the drag on the disc and vice versa. In this method the motor is roughly regulated by rheostats or otherwise, to a slightly higher degree than that desired, and then the drag magnet current is varied until the speed is reduced to the exact value wanted. Where the synchronizing magnet, still being experimented with by Geloso, happens to be used on the same disc with the speed control magnet, as shown in Fig. 7; care must be taken to see that the iron button secured to the disc for co-action with the synchronizing magnet, is placed on a different circumference than the point at which the drag magnet operates. Otherwise every time the iron synchronizing button comes around, the drag magnet will act on it also and cause a periodic flutter in the speed. The image will be checkered in consequence.

Mechanical Speed Control

MECHANICAL speed control methods next engage our attention, and several schemes are outlined in Fig. 4. Consider-

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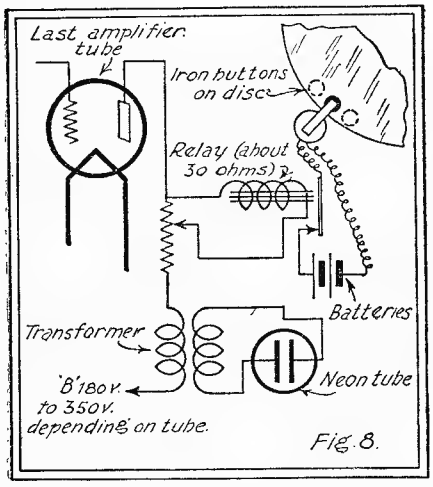
able experimenting with the WRNY television transmitter and receiver have indicated that chain belts, or belts with square holes cut into them, as shown at Fig. 4-B, are not desirable for television purposes, as they introduce a chatter which causes the picture to be broken up with a checker pattern.

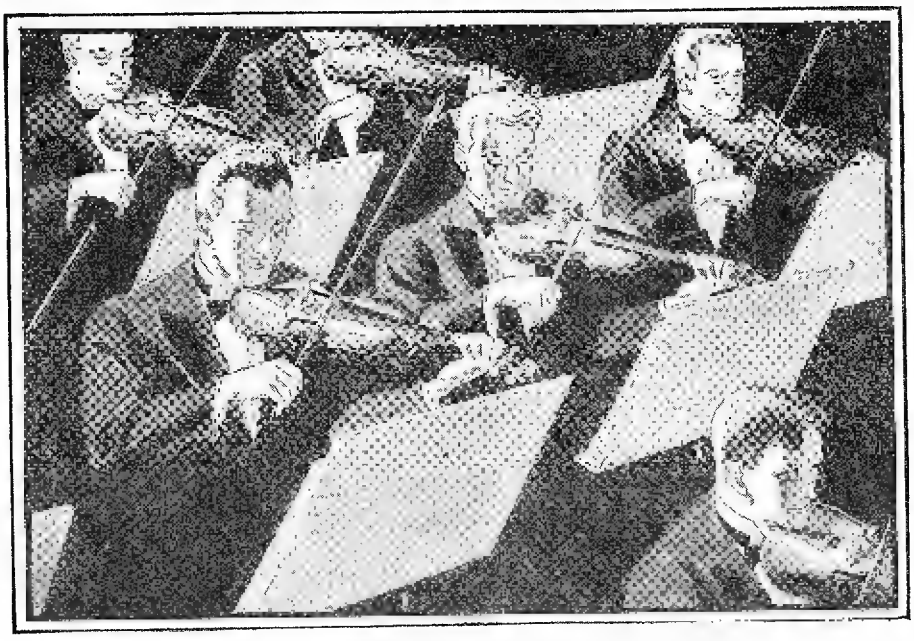
If the experimenter so desires, he may try a rubber belt of the flat or round type, as indicated at A, Fig. 4, but the best method found for driving WRNY's transmission disc involves the utilization of a synchronous motor, as shown at Fig. 4-C, the speed being reduced to about ¼ by the use of spiral gears. These gears are not excessively high in price, and thanks to the spiral cut teeth on them, there is practically no back lash or chatter set up. The spiral pinion and the larger gear mounted on the disc shaft are set at right angles, as the picture shows. Where the experimenter intends to use different speeds, and a synchronous motor operating at approximately 1,800 R.P.M. is to be used, several sizes of spiral gears for the disc shaft, or else several sizes of pinions, with different numbers of teeth on them will have to be provided. They should be arranged to be quickly placed in driving mesh in order to rotate the disc at the widely different speeds now in use by the several



A more detailed view of the Geloso synchronizing member is shown above in Fig. 8. When a synchronizing impulse (extra strong signal) is transmitted once every revolution of the transmitter disc, it actuates the relay shown above; causing the magnet to attract the iron button fastened to the disc. One method of connecting the neon tube through a transformer is also indicated above.

stations broadcasting television images. Mr. Geloso told the writer that the simple friction transmission ,shown at Fig. 4-D, however, is quite satisfactory and the experimenter will probably find this worth while trying. This method is also advocated by Mr. C. Francis Jenkins in a recent statement, in which he told experimenters how to pick up the *radio movie* images broadcast by his laboratory in Washington, D. C., on short waves (46.72 meters; 48 hole disc; 900 R.P.M.).

At Fig. 4-D an ideal method of arranging the friction transmission is outlined; here the sliding pinion is moved back and forth across the face of the iron disc by a lever, which is not shown in the drawing. A synchronous motor at constant speed may be utilized very nicely with a friction drive, such as this, with the marked advantage that once a suitable speed of the disc has been obtained, by sliding the pinion slowly across the iron driving disc, the speed will be more or less constant, overlooking the slight slippage now and then encountered with all friction transmission schemes.



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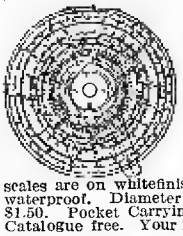

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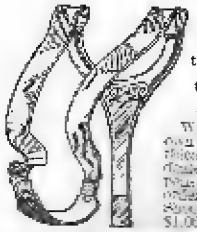

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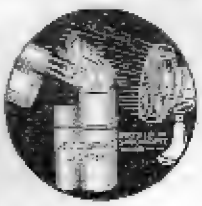

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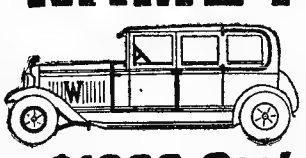

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Mr. Jenkins suggests a much simpler way to drive the television disc by friction, and it comprises a small friction disc made of one or two discs of rubber inner tube, about three inches in diameter, held between two metal flanges (2 inches in diamcter) securely mounted on a hub fixed on the end of the motor shaft. The rubber projects a short ways beyond the metal flanges, of course. The motor is mounted on a sliding base preferably in this case, and the motor and the friction disc are moved slowly in or out at right angles to the television disc shaft; when the image is seen clearly and stationary in the viewing diaphragm on the disc, the motor is in the proper position, of course, to give the desired speed. It is suggested that the television disc be mounted on the shaft of a second motor, which runs idle, no current being connected to it.

In regard to the speed relations of mechanical gear and belt drives, the following may be mentioned for the benefit of the experimenter. If a belt drive is to be used, the pulleys should be mounted at a distance between centers of not less than three times the diameter of the larger pulley. The reduction in speed is in direct ratio to the diameters of the two respective pulleys. Thus, if the diameter of the larger pulley is twice that of the smaller one, then the speed of the larger pulley will be one-half that of the smaller pulley and vice versa. With ordinary gears, the speed reduction ratio is in proportion to the number of teeth. If the pinion or smaller gear has ten teeth, and the larger gear has forty teeth, then the speed reduction is as one to four, i. e., the 40 tooth gear will revolve at one-fourth the speed of the smaller.

From all that has been said, it will be seen that one of the best methods of driving the television disc is to use a synchronous A.C. motor, operating from 110 volt, 60 cycle house lighting circuit. This motor operates at practically constant speed, and as no adjustable type synchronous motors are so far available, the experimenter will have to arrange some mechanical way of reducing the speed, such as those just described. At present the engineers of WRNY, including Mr. Geloso, their television expert, are still experimenting in the laboratory, in sending out a synchronizing impulse with every revolution of the television disc. When this is perfected to the engineers' satisfaction, it will be a simple matter to utilize a synchronizing device in the fashion illustrated in Figs. 7 and 8 accompanying the present article.

It would seem that considerable fame and money await the inventor (and this is good advice to experimenters to get busy), who will provide a simple method of regulating the speed to a constant value, for either an A.C. or D.C. type of motor, no matter what speed you have adjusted the motor to run at. One method now being tried out involves the use of a centrifugal clutch mounted on the end of a motor shaft, which serves to close a circuit through two contact fingers connected across a resistance, similar to the speed regulation scheme shown at Fig. 6-A.

In other words, every time the motor speed drops, the centrifugal clutch is caused to close a contact across the small resistance coil and the motor speed jumps ahead. As soon as the motor speeds up, the centrifugal governor opens the circuit and the motor tends to fall in speed again. If this can be worked out in a careful manner, with perhaps a little elaboration on the general method involved, it would seem that we have here a simple method for providing an adjustable, yet constant speed motor.

Captain Ranger's method of automatically regulating the speed of motors (common shunt-wound D.C. 110 volt type) is probably the best so far devised. It is fully described in the *Television* magazine Vol. I, No. 1, by Messrs. Secor and Kraus.

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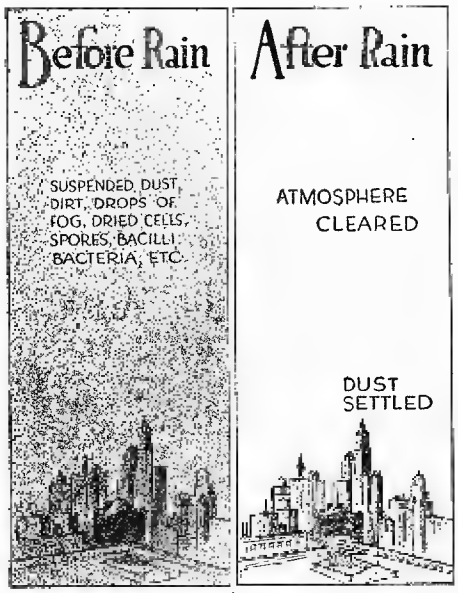
Why We Need Rain

By Prof. Dr. L. Houllevigue, Paris

(*Continued from page 698*)

whirled upwards far higher and sink to the ground much more slowly. The discovery of radium taught us their origin. We know that the surface of the earth contains in


Before Rain
SUSPENDED DUST, DIRT, DROPS OF FOG, DRIED CELLS, SPORES, BACILLI BACTERIA, ETC.
After Rain
ATMOSPHERE CLEARED
DUST SETTLED

Science has shown us that rain plays a useful role in this world. It purifies the air and removes dust, dirt and bacteria and the like. After a rainstorm, the atmosphere is cleared.

many places radio-active constituents, that produce a gas, radium emanation, which spreads about in the atmosphere. This emanation breaks up molecules which it collides with, and so forms electrically charged molecules, called ions.

To explain the production of rain drops, we used to have a very simple explanation at our hand. The air falls in temperature, water is formed; then there is nothing more to be said. But modern science will not accept this explanation, as it does not cover all the facts of the case. In reality, the formation of every single drop of rain is subject to very complicated factors, of which we are indebted to Coulier. All we want is a flask closed with a cork stopper, through which a glass tube carrying an atomizer bulb passes (see picture).

A little water is placed in the flask. The bulb is pressed strongly together, and released to take its previous form. This brings about sudden increase of the volume of air, the air saturated with vapor of water expands suddenly within the flask. This expansion cools the air in the flask and so greatly that the water vapor condenses to a visible fog. The drops of this mist have not done all this by themselves. Every one of them has connected itself to one of the particles of dust floating in the air. This fact can be shown in two ways. First, by strengthening the cloud formation by increasing the number of ions in the air by passing radium emanations or Rontgen rays through it. And secondly, by the fact that no more mist is produced if the experiment is repeated a few times because the precipitated mist in every case carries down with it the little particles of dust, which act as cores for the precipitated particles of water, so that the

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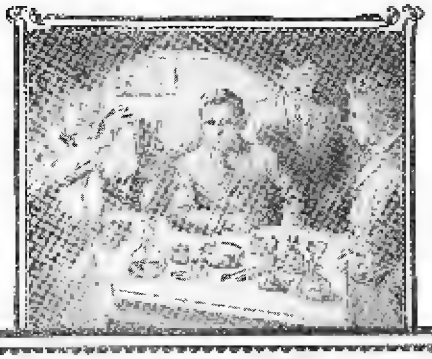

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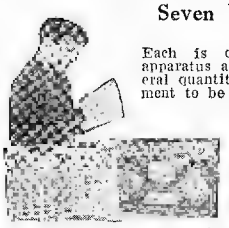

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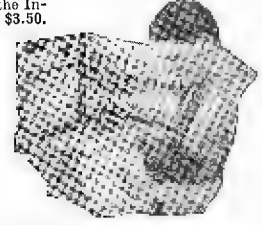

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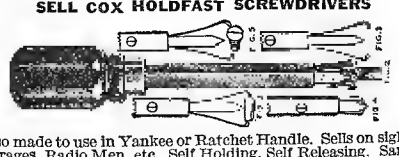

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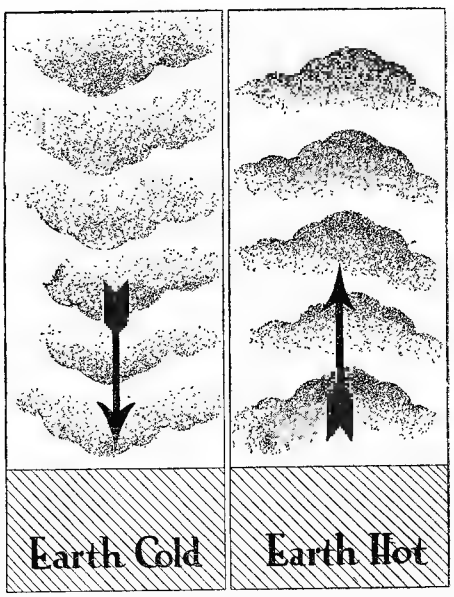
air in the flask is gradually cleared from all its dust which can effect the precipitation in question. Every drop of the mist needs for its formation a material center, whether a particle of dust or an ion. This is the result which the experiment described leads us to. And now we will see how nature reproduces the same experiment on a large scale.

We always have in our atmosphere a great quantity of air rich in water vapor, although it is not completely saturated. Now this water vapor is absolutely transparent and has no effect on our seeing. If such air by any cause whatever is drawn up to a great height, as if for example it passes through a colder and more saturated layer of air, the atmospheric pressure affecting it is diminished the higher it rises. Accordingly it expands, its volume increases, and thereby it gets cooled more and more until at a given moment, it becomes saturated. At this instant, the water vapor condenses into little drops, precipitating itself on the dust of the air and on the ions. The drops are



When the earth is cool, the water vapor in the air condenses and gives up its heat. If the temperature rises, the water evaporates and takes up some of the heat, as illustrated.

at first not large. (They measure about 1/100 to 2/100 mm. in diameter), but they increase very quickly in size as the ceaseless movement of the mist favors their coalescence with other drops. Larger and larger drops are produced which are heavy enough to fall with considerable velocity. So they collide with and unite with dewdrop and finally reach the earth as pouring rain from which they originally rose as a pure volume of gas.

The production of rain therefore is by no means such a simple process as we generally think it is. Above all, atmospheric electricity plays a very important role here, Accordingly we have today impressive proofs, which are based among other things on the results of experiments in the dissipation of mist by electric waves. It is certain, for instance, that a mist surrounding the antennas of working broadcast stations, disappears and interference of a similar kind is to be ascribed to the fact that in a thunder storm lightning flashes always pass through the air before the first raindrops fall.

Why all this is so interlocking we do not know. In any case it is certain that the particles of dust which form the centers

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of the raindrops are carried down to the earth by the falling drops, and that the rain thus clears the layer of air lying between the rain clouds and the surface of the earth from dust and dirt. Furthermore, the formation of new dust is prevented, because the moistened surface of the earth can produce no more dust. The final result of every rainstorm, therefore, is a thorough cleansing of the atmosphere, which cleansing is all for our good, and for which we ought to be very thankful instead of scolding about the rain. I have no doubt that the knowledge of these natural changes will induce the authorities of our cities to give up the old ways of cleaning the streets, replacing them by washing down the dust. This they will be able to do by establishing artificial rain stations on the roofs of buildings, so that the water can be made to fall therefrom in fine drops.

The benefits of the moisture of the atmosphere are not yet completely described. A very important point is still to be noted. Our poor humanity has such a nature that it is very sensitive to changes of temperature, far more than it is affected by the temperature itself. Mankind lives in Greenland; mankind lives in the Sahara; but a sudden change of temperature of five to six degrees is enough to give us a cold. The ideal climate is that of countries in which the unavoidable changes in temperature take place very slowly. But in these changes, the water vapor in the air plays a principal role, in which it acts as if it were a thermostat. It prolongs the interchange of temperatures between earth and cosmic space. The heat of the sun is less oppressive when a screen of clouds comes between the earth and the sun, and in the night the surface of the earth becomes cool more slowly, if the heavens are covered with a mantle of clouds.

But this comparison goes still further. Everybody knows that it requires a great deal of heat to evaporate water. Exactly 80 calories are necessary to convert one gram of water into vapor or gas. But if one gram of water vapor comes back into the liquid state, it will give up the same 80 calories to the air, which have been absorbed. Water, therefore, is the greatest heat regulator of our earth. If there is a tendency towards sudden cooling, the water vapor in the air condenses and gives up thereby its heat, which opposes the chill. If the temperature rises, water evaporates and takes up this superfluous heat. This is the reason why countries with damp climates have the least variations in temperature. In Valencia, in cloudy Ireland, the difference of temperature in winter and summer seldom exceeds eight degrees, while in Siberian Nerchinsk, which is almost on the same parallel of latitude, the difference has attained fifty-four degrees. Perhaps this great difference is in accord with the fact that we middle Europeans often have trouble to understand the operations of the Russian soul. By the uniformity of our climates, we are accustomed to moderation and taking the middle course, while the soul of the Russian people is the daughter of a country, in which the opposite obtains. All we can do is to suspect these interrelations, but we cannot prove them. The developing knowledge of geopsychology will eventually give us information on such topics.—*Reclams Universum.*

In December RADIO NEWS

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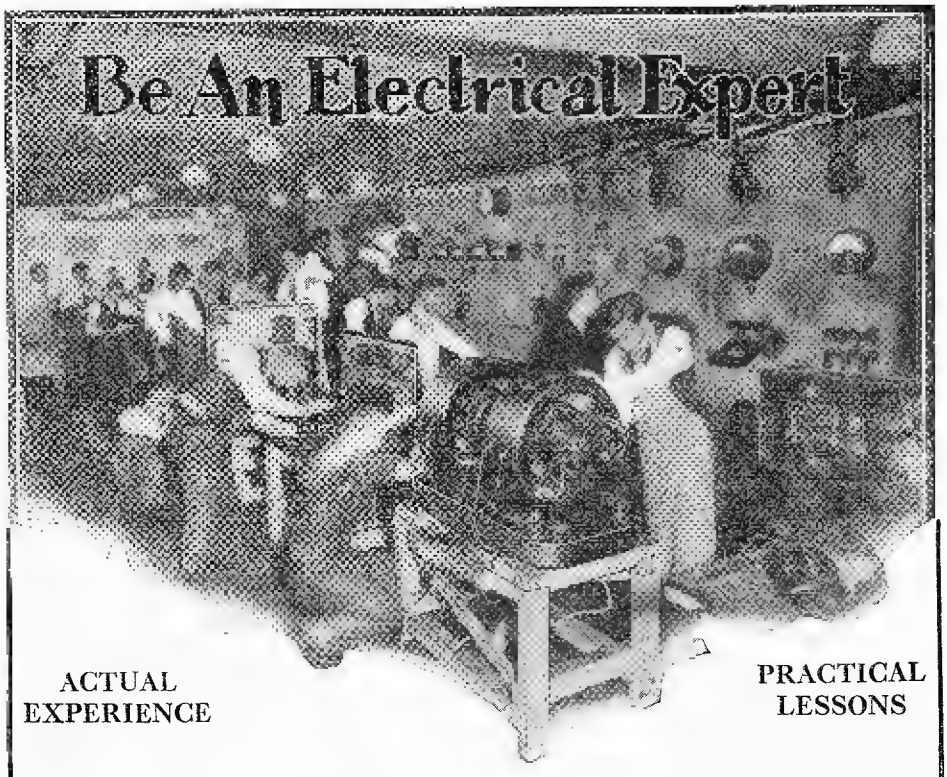

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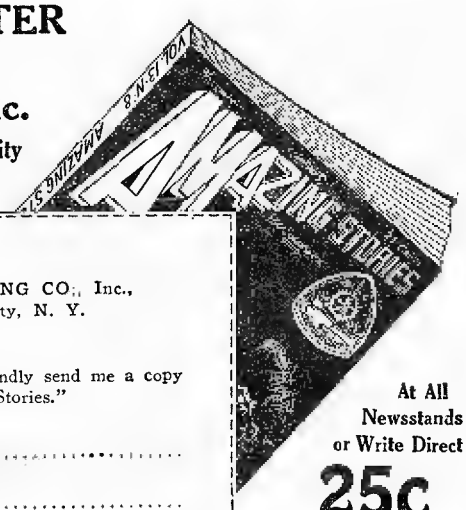

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Making a Small Lathe

By Hi Sibley

(*Continued from page* 718)

done neatly on a lathe, but never well done with a jackknife.

Standard parts of a well-made construction set serve nicely for the important features, and should include a shaft or spindle about five inches long; a sheave or pulley three inches in diameter or larger, two brass collars, a sprocket with hub and set screw (pulley also must have hub) and a gear or face-plate with hub, to which flat pieces can be screwed for cutting out pulleys or other circular work.

Begin with the bed, using parallel pieces one inch by one inch by 20 inches, or whatever length your work requires. It is better, of course, to use screws throughout, although this takes more time. Long wire nails can be used instead. Soft wood will do for the bed if you do not care to make a more finished job with hardwood. On top the parallel bed pieces fasten two strips ¾ inch by 1⅜ inches, full length. These overlap the bed pieces ⅜ inch on the inside, and serve both as guides and a means of clamping down tailstock and tool rest.

As you will see in the drawings, the tailstock slides on the bed as required, but the headstock is stationary. The most difficult job of all is to bore the hole in the headstock and for the center in tailstock true and in line with each other. This is vitally important for a smooth-running lathe.

The hole in the headstock for spindle should be large enough to easily clear the shaft used, say about ¼ inch for a ⅛ inch shaft, and then in each end counterbore out large enough to receive the bearings to a tight fit, flush with the outside of the block. The shoulder in the bore prevents their being forced into the block under pressure of face turning.

These bearings are simply the standard brass collars sold with a construction set, and measure about ⅜ inch in diameter by about ¼ inch in face, with a tapped hole for set screws. Screws are removed and the hole serves for oiling by means of a hole drilled down to meet it in the headstock block.

File the end of the spindle down to a sharp, flat edge, and make your spur center from a small sprocket by cutting away the sides and filing sharp points which are bent over at right angles. Before screwing down the bearing block on headstock, draw up the tailstock and see that the screw-point center lines up correctly. The tailstock center is merely a wood screw ¼ inch by 2½ inches with the end threads filed smooth.

As your lathe will not permit heavy cuts, the tool rest can be made of ½-inch hardwood, with a slot for lateral adjustment. Both tool rest and tailstock are held in place by means of a clamp block drawn tight against the under side of the ways with a thumb nut and 3-16 inch carriage bolt. The squared section of the bolt just below the round head should be forced into the clamp block so that bolt will not turn.

It is assumed that you have made the ways square and smooth and absolutely parallel, so that the guide block fastened to the under side of the tailstock will fit neatly but will not bind at any point. It might be well to wax these parts to prevent swelling in damp weather and to permit their sliding easily. The bolt hole through tailstock should be large enough to clear the bolt shank, or at least to allow bolt to move freely within it. A washer should be used under thumb nuts on both tailstock and tool rest.

(*Continued on page* 761)

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As the latter can be adjusted in any position, the young wood-turner can face off flat work on a face plate, as shown in the diagram. This is handy for cutting out small pulleys, wheels, etc. For cutting off, the writer made a special tool of a large nail filed to a narrow cutting edge, tapered toward the bottom and back to give clearance. Keep the edge as sharp as possible with an oil stone. A nail isn't the best tool steel in the world, but will serve if frequently sharpened.

It is understood that a toy motor will not pull enough for heavy cuts, and it will be necessary to round your stock and have it well centered before starting to work on it. Even at that, your cuts will have to be light.

However, with a sewing machine or similar motor, and heavier spindle with bearings made by boring the right size hole in blocks of cast iron or brass, this same lathe will turn out much heavier work and permit using hardwood. The time required to make this lathe is negligible compared to the thrill of having your first machine that will turn out real work. As with all high-speed machinery, it should be kept thoroughly oiled at all times, and be sure to see that the tail center gets a drop of oil frequently.

Cements and Glues

By Dr. Ernest Bade

(*Continued from page* 716)

first soak the chips in cold water, using enough of the latter to completely cover the mass. When the glue has swollen, add a little more cold water and heat gradually. Never boil such a glue, just heat sufficiently to liquefy and then use. In order to prevent the glue from becoming brittle when it has dried, a very small quantity of glycerin may be added. This will keep the glue flexible.

When a glue of very great adhesive properties is required, it may be prepared with the aid of linseed oil. First soak carpenter's glue in water and, when the mass has swollen after a lapse of about ten hours, pour off the excess water and add a quantity of linseed oil equal to the quantity of glue used. Heat this and stir until a jelly is formed.

Acid-Free Paste

AN acid-free paste or gum glue is often a necessary and it is prepared by means of powdered gum tragacanth or gum arabic. The gum is to be dissolved in water and a few drops of glycerin are added. The paste with gum tragacanth is very sticky and cheap in spite of the fact that the gum itself is expensive. One ounce of the powdered gum is sufficient for about a quart or more of paste and it is prepared by adding one part of alcohol to the gum and then adding one part of water. Stir or shake thoroughly until a thick paste is formed. The mixture may be thinned if desired, by the addition of water. The alcohol present acts as a preservative and keeps the paste for a very long time.

Knives which have become loose from their handles may be reset with a special cement prepared by heating rosin to the melting point and adding a small quantity, usually about half the quantity of rosin used, of powdered or precipitated chalk. Stir the mixture thoroughly and then pour it into the wooden handle. Quickly heat the tang over a flame, holding the knife with a pair of pliers, and rapidly insert the tang into the rosin mixture, still hot and soft. This will set the knife firmly in place.

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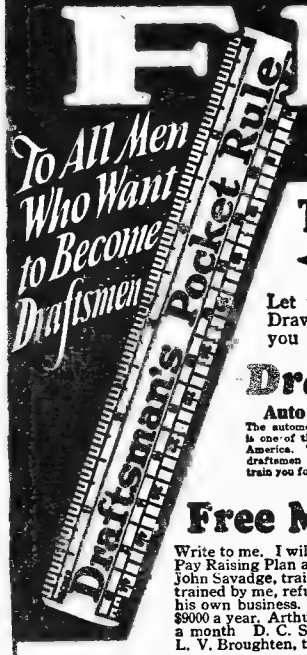

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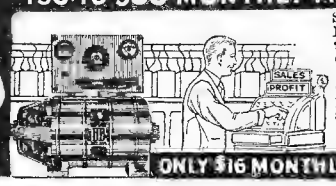

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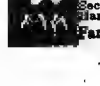

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Drama via Television

(*Continued from page 694*)

amplifiers. All are mounted on tripods and can be raised or lowered to suit the position of the actor. In the presentation of "The Queen's Messenger," three cameras were used, one for each of the characters, and the other for visual effects. The adaption of the television apparatus to the play was made by Mortimer Stewart, director of numerous radio plays. The director standing between the two cameras used for the actors had a small control box, by means of which he could bring any one of the television cameras into the circuit. Images were also faded in and out by turning a knob. In front of the director was a receiver which enabled him to see the image being transmitted and thus check the performance. In addition to this apparatus there was a microphone for each actor used for the transmission of speech. The picture went out on two wavelengths, 379.5 meters and 21.4 meters, while the voice was transmitted on 31.96 meters. Because of the limitations of the art at present, only the heads of the actors could be transmitted. To further the action, therefore, a third transmitter was used for the hands and various "props." In this way added realism was given to the performance and the monotony of head images only was relieved. Each character worked in front of a white screen, so that the features were sharply defined. It was found that objects which reflected the light, such as diamond rings on the fingers, could not be used because they produced a disturbing glare in the image.

Television Drama of the Future

IT is not too much to hope that in the near future we will have *talking, stereoscopic, colored radio movies*, such as those illustrated in the accompanying drawing. A receiver will throw the images upon a screen in much the same manner as is shown in the photograph of the screen and receiver only, of course, the screen of the future will be of a large size, such as those used in moving picture theatres today. In order to obtain a stereoscopic effect, the image will be scanned, for example, with a disc having two spirals of holes, such as that used in the Baird system. On the back of each seat and in front of the spectator will be arranged a stereoscopic eyepiece through which the screen will be viewed. Two images are thrown on the screen separated about one-half inch, and when seen through the familiar twin-prism eyepiece, stand out in relief. In order to obtain colors, three separate spirals of holes are used for the red, blue and green components in the transmitted image. At the receiving end a Moore neon crater tube and a tube filled with helium and mercury are used and when scanned by their respective spirals in the disc, an image colored in the same manner as that in the transmitter is seen.

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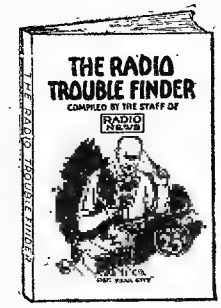

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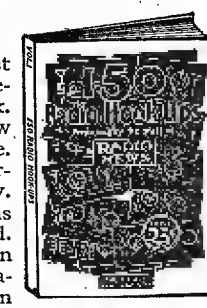

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Money Making

By Al. Bert. Cole

(Continued from page 693)

of paper money, equivalent approximately to $4,12o,654,000 is the average yearly output of the Bureau of Engraving and Printing at Washington. This is complicated by the fact that this gigantic total must be printed in 39 different forms, according to the requirements of our curious currencies.

The automobile has increased the use of currency nearly four-fold. It has also increased

THE automobile has increased the use of currency nearly four-fold. It has also increased its mortality. When crisp, new bills come in contact with oil, grease and dust, the results shortly are quick trips to the government macerating machine. There is no doubt, according to government experts, that the automobile has individually done more to increase the cost of government printing of currency than any other single agency. This has been true because money has been used in smaller amounts than when travel was by railways. Oil and gas alone has meant the handling of millions of dollar bills.

Our use of national currency is three times greate rthan it was in 1910 and six-fold more than 25 years ago. Formerly paper money was good for 16 to 24 months of commercial service. A year and a half ago, when the quality of the paper bills seemed lowest, their life was only about seven months. At the present time scientific study and day and night work has increased the length of time of service so that they are good for nearly nine months active service.

This applies largely to the dollar bill. The larger denominations last longer. Yet once every twelve months the Treasury must renew all stocks because of the wear and tear and oil and dirt.

The Bureau of Engraving and Printing operated at capacity is only large enough for current demands and has been steadily falling behind. At the present mortality of paper money, it is estimated that the government will find it necessary to enlarge the size of the already large plant.

In order to increase the life of the printed money the Treasury officials recently ordered an intensive study made of the various aspects of the problem. All available statistics and an intensive scutiny of existent conditions and demands, it was decided best to call in science to wrestle with the problem and suggest what should be done.

The Bureau of Efficiency and the Bureau of Standards were assigned to the investigation. The paper used, the way it was used, and how frequently used, were the chief phases of the task. The chief motive behind the whole problem was to determine, if possible, the weaknesses of the paper money and if possible discover a means of strengthening this weakness.

Testing Out Paper Money

CURIOUS testing measures were devised and unusual laboratory conditions obtained that would simulate the ways and methods by which the money is worn out. These experts reduced the figures for the durability of the dollar bill to strength and longevity figures. Mechanical fingers were used to determine the tensile strength, resistance to tearing, and other machines tested the opacity, gloss, weight, thickness, bursting strength, rubbing strength, surface wear and folding endurance of samples.

The rubbing test duplicated the surface wear to which paper money is exposed in

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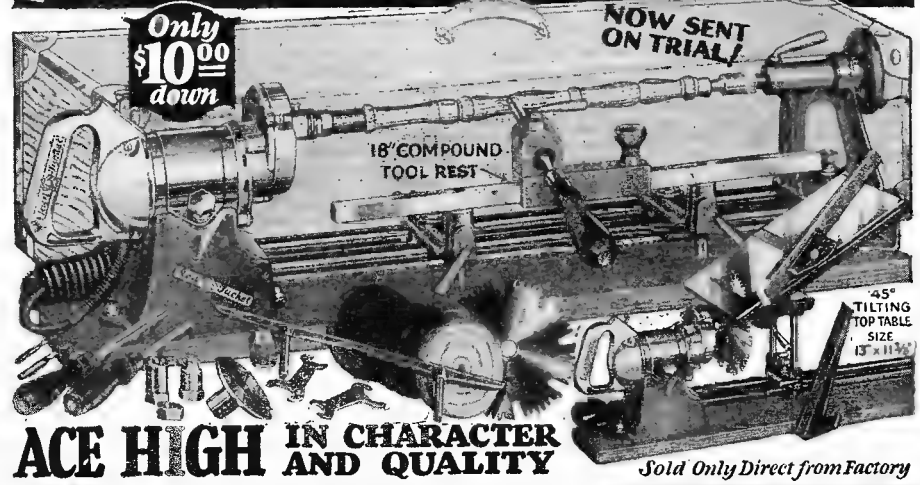

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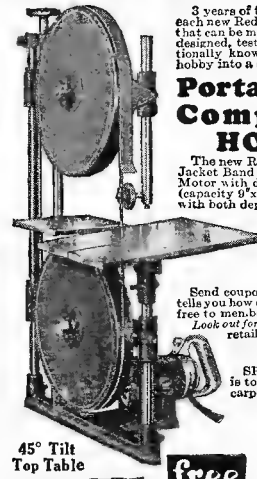

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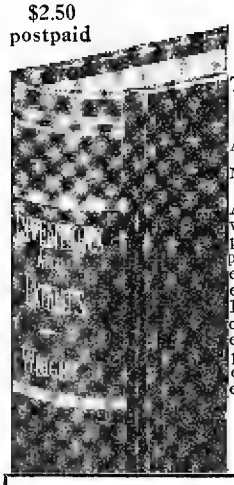

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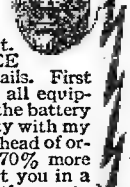

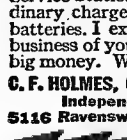

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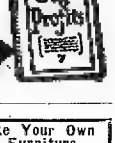

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business. An eraser was mounted in such a way that it could be rubbed back and forth over the surface of the paper with an automatic recorder which kept count of the reciprocating movements. This test was continued until a hole was rubbed through the paper. A comparison of the number of strokes required to wear through the different samples helped to secure the one capable of enduring such a test for the greatest number of strokes.

Paper samples were suspended in turn between the jaws of a tensile strength testing apparatus. After the paper was fastened in place the distance between the jaws was increased by turning a control wheel. The sample would stretch to its limit and would finally break under the severe strain. A pendulum gauge recorded the total pulling force exerted as the paper broke. These data were the index figures which denoted the tensile strength of that particular specimen of paper.

The Folding Test

ANOTHER device used was for ascertaining the tearing strength of paper samples, a recording register noting the maximum stress which each specimen would withstand before falling. The opacity of the paper was studied by the utilization of illuminated photometers. Thus were thin spots discovered, blemishes and other defects. The opacity tests were of particular importance due to the fact that all money is printed on both sides and in different inks.

One of the finishing processes associated with paper production consists in running the sized paper between powerful steel rollers in order to smooth and gloss the paper properly. The Bureau of Standards, with special optical apparatus studied the various types of gloss. The amount of light reflected from a shiny surface was considered a test of the glossiness.

The weight of the paper samples is calculated by the use of an extremely accurate torsion balance, while the thickness of the specimens are determined by a special measuring or calibrating device. Electrically operated machines fold and unfold the paper until it finally cracks and breaks under the action of the machine. Currency paper sub-

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jected to this endurance can be folded some 2,000 times before breaking.

These and other tests were conducted in a constant temperature chamber of the Bureau of Standards. As paper is very susceptible to changes in temperature and humidity, a constant temperature of 70 degrees and a humidity of 65 was maintained in order that the tests should be under identical conditions for all samples used. All types of paper were tested that might be of some value in the printing of money. The data has been compiled by the Bureau of Efficiency and is now being used in raising the quality and efficiency of the paper money.

These various tests developed much valuable information. The order to change the size of paper currency was but a part of the result. It was found, for example, that whereas a beating of the paper pulp for 24 hours permitted a folding maximum of 2,000 times, a beating of the pulp for but 18 hours increased its endurance when finally finished to 4,000 foldings. Some of it actually withstood 5,000 foldings.

Paper in the making is plunged into a glue bath in order to bind and cement together the multitude of fine fibers which give the material strength. Science has found that by spraying the paper with formaldehyde after it is removed from the glue bath, a dirt-resistive glaze is developed. It is expected that this treatment will aid in combating the dirt, oil and grease, among the worst enemies of paper money.

The paper which is used by the Bureau is made at a factory in Massachusetts. No visitors can go through the paper mill, which is run by an outside agency on contract with the government. There is no secret about the composition of the paper. That used for money and bonds is made chiefly of linen, though a scarcity of material forced them to use cotton almost entirely during the World War, and for a time afterward. The secret of paper making is in the little silk threads imbedded in the paper and the way they are put in. It is unlawful to describe the process. No other mill may manufacture paper of that kind by any process

(*Continued on page 767*)

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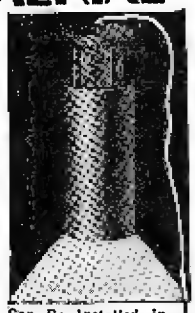

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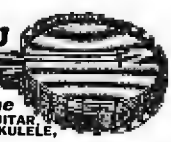

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Money Making

(Continued from page 765)

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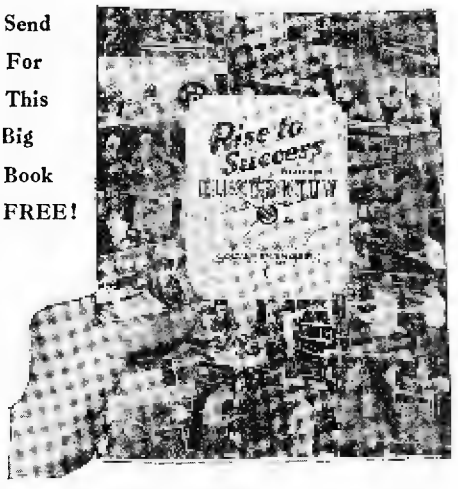

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It takes more than $7,000,000 a year to pay the operating expense of the Bureau of Engraving and Printing. Some of that comes directly from outside agencies that have to pay for work done, such as the Federal Reserve and national banks. The rest is an overhead charge, chiefly on money and bond manufacture. But it isn't a tax in the strict sense, for all the government's expense in producing paper money and bonds is more than made up by the securities that go out and never come back for redemption. It is estimated that one per cent of all national bank currency is never redeemed. But it doesn't accrue to the banks, even when they go out of business; but goes into the United States Treasury, where the fund held for the redemption of bank currency alone amounts to about $40,000,000. Most of this will never be drawn, for the money represented, no doubt, in the main, has been destroyed or lost beyond recovery. Yet every now and then somebody comes along with an old bill or other government obligation that should have been redeemed a long time ago. Recently an Illinois woman brought in a thousand dollar certificate issued in 1853 to indemnify Texas for Mexican war claims. The bureau pronounced it genuine and it was paid.

Have you become a "HOME MOVIE" fan yet?

Turn to page 714

The United States is radically different from the average country in that it maintains five national currencies instead of one. The foreign countries, almost without exception, have only one currency. The fact that this nation supports a quintet of currencies complicates our financial activities in multitudinous manners. Previous to the Civil War, this country did business mostly on gold and silver basis. The paper money was issued by state banks. Our paper money was created for emergency use during the trying times of the Civil War. The greenbacks, or our first and oldest United States notes, which have been in circulation since Civil War days and have never been redeemed, were our first currency. Their value fell as low as 40 cents during the war because they were not redeemable in gold or silver.

Thirty-nine Currencies

OUR second currency consists of national bank notes, which are secured dollar for dollar by government bonds. The third form features the use of gold certificates. About the end of the Civil War, the United States made provision for the exchange of gold for these certificates. The certificates were really warehouse receipts which were presented to those persons who store their gold with the United States. In the late 70's another currency was created. It consisted of silver certificates distributed among those who placed their stores of silver with the government for safe keeping. Finally, in 1913, our Federal Reserve currency was developed, after comprehensive study. It is the most flexible of our currencies and is adapted for expansion or con-

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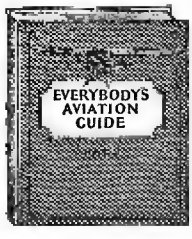

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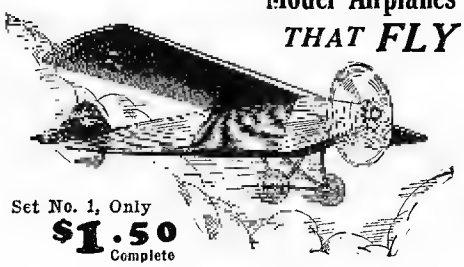

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traction in accordance with country-wide needs.

The Bureau of Engraving and Printing produces 39 different models of paper money as a routine job. It is probably true that only a big banker knows these various forms. The average individual could not distinguish them. Most people recognize currency only as to denomination. This is unfortunate, for it makes deception by crude counterfeiting possible.

The Treasury Department, recognizing this as being true, has an official movement in progress to reduce the 39 varieties to 11 essential types. With only 11 models, the average citizen should soon know how to accurately identify all the bills, bank notes and certificates. Under the proposed plan, instead of having five different models of the $10 bill, for example, we will have but one standard type. It will save much expense in printing. To differentiate between the different currencies, identifying seals for each will be used. These can be surface printed on the bill after it has been made in quantity production. This plan, it is estimated, will intensify the efficiency of printing activities approximately 500 per cent.

New Currency Portraits

IN the new currency reform, the standardized one dollar bill bears the picture of Washington, the $5 bill will present the features of Abraham Lincoln, the $10 the likeness of Theodore Roosevelt and the $20 the photograph of Thomas Jefferson. The currency identification of these bills will be centered in the distinguishing seals. Eleven models of money, each representing a denomination, will do the work if this move is completed and answer all purposes for which 39 are now used.

The 11 models of money, as suggested in the redesigned currency bill, represent denominations which range from $1 to $1,000. Money, as all know, is made in denominations of $1, $2, $5, $10, $20, $50, $100, $500, $1,000 $5,000 and $10,000. Naturally, the $1 bills are exposed to the greatest wear and there is a demand for more of them than of the others. The fives and tens are also subject to strenuous service. The $20 bill has a normal life of about two years and is not used as extensively as the fives and the tens. The higher denominations are even less used by the general public than the twenties. Probably there are many citizens who have never seen a $500 and $5,000 bill.

Recently the Chicago Chamber of Commerce started out a new bill, with a circular attached requesting every person handling the bill to make a notation of its use. In fourteen days the dollar was spent thirty-one times. It was new when it started out, but when it came back it was soiled, wrinkled and badly worn. In the fourteen days it was spent five times for salary; five times for tobacco; five times for cigarettes; three times for meals; once for automobile accessories; once for bacon; once for washing powder; once for garters; twice for shaves; once for toothpaste. All of which gives an accurate picture of the strenuous life of the humble dollar greenback.

Employees Honest

BUT to get back to the printing of money. About 125,000 sightseers now visit the Bureau of Engraving and Printing every year. The chief surprise that they receive is the apparent freedom permitted everyone employed in making money. Though money passes through their hands in great bundles and with as little seeming formality as the rushing of collars from worker to worker in a laundry, the thousands of workers go and come and mingle together with as little restriction, apparently, as employees of any other place. To the visitors it would seem possible for any one to stick bills representing millions of dollars into an inside

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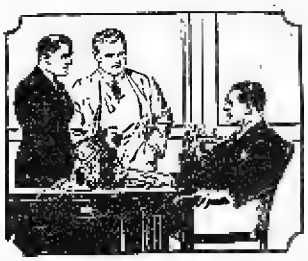

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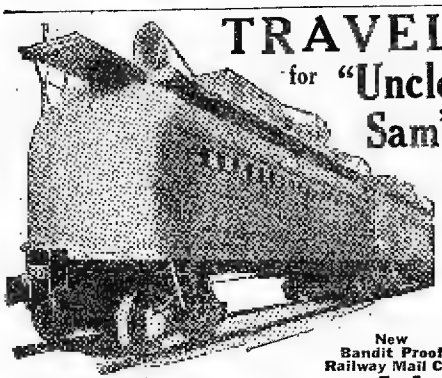

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coat pocket and get away with them, for there is no searching of persons or garments. In fact, it is entirely possible to put the bills in the pocket, but it is another thing to get away with them. Many attempts have been made, but all, say the officials, resulted in discovery and usually were followed by terms in prison.

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Can We Control Sex?

By Dr. Oscar Riddle, A.B. Ph.D.

(*Continued from page* 685)

considered in mass, but it varies from 105.2 to 107.2 in the different countries. To what do you attribute this variation?

Q. 7. It has also been held that diet has much to do with the control of sex. Do you believe that if the male is a great meat eater the offspring will sway (A) in his favor, (B) toward the female?

Q. 8. Another favorite theory is that the proportion of males can be increased over that of females or vice versa, if impregnation takes place just before (in one case) or immediately after (in the other case) the menstrual period. What is your opinion?

Q. 9. Do you hold that if the male is weaker physically than the female, the offspring will preponderate (A) in male, (B) in female. (It might be mentioned that sex reversals in animals have been produced by starvation and diet change.)

Q. 10. Do you believe heredity has anything to do with sex?

1. A and B marry. In A's family there are four males and one female; in B's family there are six males. Is it likely that males will predominate in the offspring?

Q. 11. Do you hold that if the male is a moderate drinker, there would be a preponderance of males in his offspring?

Q. 12. From any facts which you may have in your possession about a large family, how is this family divided with reference to the number of males and females? Do any of the above theories seem to apply?

Q. 13. Have you carried on any experimentation along these lines or compiled any data? If so, what are the facts deduced, or the figures?

Q. 14. (a) Do you believe the phases of the moon have any effect on the nature of offspring?

(b) Do you hold that sunlight has has any effect on the nature of the offspring.

(c) Do you believe that there is any import in controlling sex, to whether the spermatazoön came from the right or left testis?

(d) Do you believe that the right or the left ovary dictates the nature of the offspring?

If your answer is yes to any of the above questions, please explain here.

Conclusion

Q. 15. What is your own opinion as to the cause of sex differentiation? Have you a favorite theory of your own? What, if any, are the experimental or practical demonstrations?

Watch for the other articles in this series and also the results of the questionnaire.

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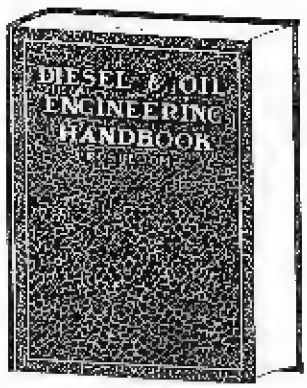

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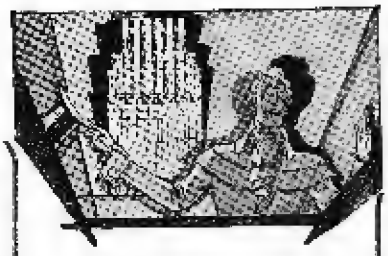

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Filming Submarine Disasters In the Movies

By Don Bennett

(*Continued from page* 703)

the lights were placed around the sides and top of the tank, no light being used on the side toward the camera. You can readily see this in the illustration (Fig. 2), showing a close-up of the diver. See how the upper side of his equipment is brightly lighted, as are his sides from the arm down? The front is in almost total darkness.

THERE are scenes in the film showing the collision with the destroyer, a masterpiece of double-exposure, as shown in the illustration (Fig. 5.) First the film was exposed on the destroyer rushing through a stormy sea. Then it was re-exposed on a mask that showed the fine cross lines of the periscope.

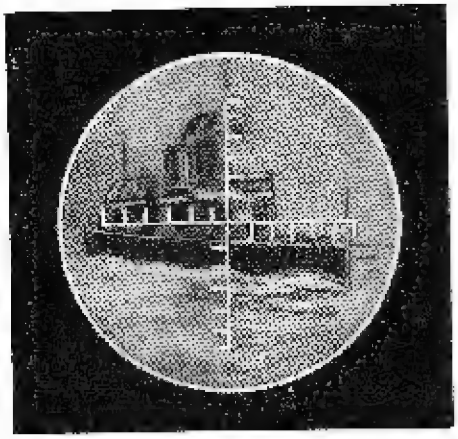

Fig. 5. How the shot of the destroyer was illustrated as if seen in a periscope.

The scenes immediately following the one described above show the submarine slowly sinking to the bottom. This was accomplished by building a scale model of a submarine and sinking it in the tank. Compressed air is fed to the model and escapes through holes pierced in the side (Fig. 3). This freed air goes upwards slowly toward the surface, a feat accomplished by slow-motion photography. A large volume of air at a great depth in the ocean would rise slowly, while a small but magnified quantity would rush up the few feet in the miniature tank. To overcome this, the escaping air bubbles were photographed at the rate of 128 pictures per second, which, when projected on the screen at normal rate of sixteen per second, gives the effect of a large volume of air moving slowly.

Another model was used in the opening sequence of the film (Fig. 4).

A replica of a submarine was built in the studio. As you can see by the illustration (Fig. 6), many of the details of the original are in the set. The deck section, hidden by the ribs overhead is missing to permit the lighting of the interior.

Note to amateurs: The tank scenes can be duplicated by you with your small cameras by careful attention to the angle of the light. Be careful that no reflections show in the side of the glass toward the camera. Light should be from top and sides. A square aquarium is an excellent tank for this purpose, and after you have practiced on the goldfish, put in a model and try some "submarine" filming. A scale model suspended from two strings should offer excellent possibilities for a hundred-foot "war" film. Make a model of a surface vessel, agitate the water with a fan, and let the submarine torpedo it!—*Photos courtesy Columbia Pictures.*

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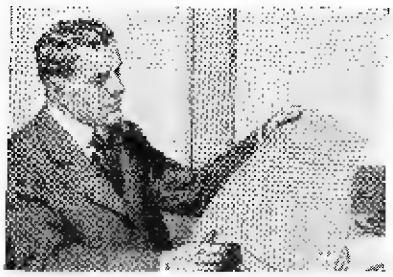

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Cities of Tomorrow

(*Continued from page* 750)

tance that has ever been invented by man," he said. It was the famous inventor's idea, expressed to the interviewer, that huge airplanes will be the best carriers of passengers and freight across the ocean and continents in the future; and he thought it entirely possible that the engines of the future may be of the turbine type, with greater smoothness of power and also higher efficiency than the present types.

Subways and Automobiles

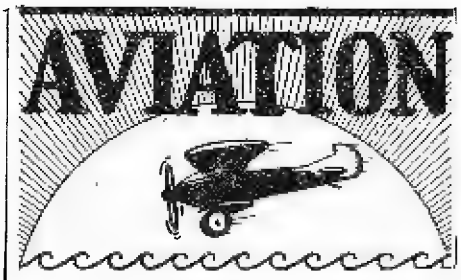
IN regard to subways of tomorrow, our inventor thought that there would be a little change in the general design of the cars, wheels and rails. He is a strong believer, however, in the moving sidewalk, arranged in triple fashion; that is, with low, medium and high speed platforms, so that a person can walk easily from one to the other. I asked Dr. de Forest over what lengths of subway he thought moving sidewalks would be desirable and successful in the future, and he said that he thought they would be very useful for the subway system extending from 125th Street to the Battery in Manhattan, a distance of about 8 miles. For widely separated express subway stops, the regular trains were desirable, he said, and in answer to the question as to whether or not he thought we might be traveling in ultra-high speed subways in 25 years from now, the cars of which would be propelled by vacuum or by compressed air, he did not think that this idea was very feasible. Likewise the Doctor did not think that there was much of a chance that subway engineers in the future would take very kindly to the Bachelet magnetic levitation system whereby a metal car is suspended above the tracks and moved along by magnetic impulses. In preference to this and other very ingenious schemes worked out by inventors, many of which have been patented, Dr. de Forest believes that we will use motor propelled subway cars rolling along on wheels over steel rails for many years to come.

The automobile was the next point of attack ventured upon in the interview, and the inventor of the famous Audion expressed himself as quite well satisfied with the modern motor car, especially from the viewpoint of the beautiful design of the bodies. He believed, however, that before long we would see the elimination of the gears now used to give various speeds and he did not think that the European idea utilized in some of their cars, of placing the engine in the rear of the car, is a very good one. In view of the fact that Diesel engines of small size and having a weight of about 3 pounds per horsepower have been completed and tested successfully on airplanes, both in Germany and in this country in the past few weeks, Dr. de Forest said that undoubtedly one of the changes we will see during the next few years will be the adaptation of many engines burning heavy fuel oils such as the Diesel type, or other styles of engines which will burn a much more economical fuel than the gasoline—a fuel to cost one-third as much.

Radio to the Planets

INTERPLANETARY radio is always a fine question to ask any scientist familiar with the technique of electricity and radio. "Do you think, Doctor, that we will be able before a great while, to send out radio signals in an endeavor to communicate with Mars or other planets which may possibly be inhabited by intelligent beings?" the interviewer asked.

"I do not believe that radio signals can be transmitted beyond the atmospheric envelope surrounding our earth, due to the reflection of the radio waves from the Heaviside layer," said Dr. de Forest.



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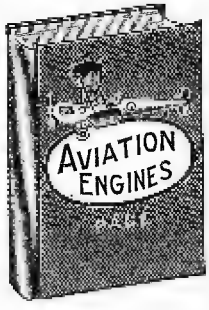

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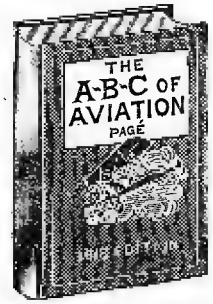

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Cities of Tomorrow

By Harvey Wiley Corbett

(*Continued from page 686*)

future buildings, Mr. Corbett stated that partitions in offices and other public apartments, would be made of a glass substitute, so as to be transparent and transmit light through the whole floor. Also there will be no brick or stone masonry as we know it today, and buildings will be assembled very rapidly, the outer covering being composed of large panels of some rust-proof metal, the panels of large size being bolted, riveted or possibly electric spot welded into place. These metal panels could be enameled in different colors on the outside in the same manner as the new steel tile now being marketed. This new steel tile marks a big step forward, and it comes in various colors, which should prove much cheaper than ceramic tile. Undoubtedly before long the company making the new modern steel tile in pieces a few inches square, will be making this in large sheets, with the tile marks embossed on the metal, so that instead of a tile setter putting the tile in place, any mechanic handy with a screw driver will shortly be able to tile his bathroom, and fasten the sheets of enameled steel imitation tile in place with a few screws.

Streets of the Future

THE streets in the city of the future, according to Mr. Corbett's ideas, will be arranged in one or more levels if necessary, while the sidewalks will be arcaded and arranged in two or more levels, as occasion may demand. In this way, the sidewalks will be protected from the elements, if the scientists of fifty to one hundred years hence have not removed the menace of rain and snow to pedestrians by scientific control of the weather. Pedestrian traffic will not have to cross motor vehicle thoroughfares, and further, automobile traffic on cross streets will not cross the avenue thoroughfares, the way it does now in all of our big cities, with the consequent confusion and continual periodic halting of the traffic on the avenues. Mr. Corbett has worked out a design for the streets, whereby the cross streets weave under the avenues, so that motor vehicles move in continuous stream on any street; also all streets would have traffic moving in one direction. In other words, alternate avenues would carry northbound traffic for example, while every other avenue would carry southbound traffic. This arrangement has been partly worked out and put into use in some of our larger cities at the present time.

Automobiles will skim along smoothly at reasonably high speed, with no strong fumes issuing from exhaust pipes on every car, for they will be propelled by electric motors, receiving their energy from radio waves, radiating from a series of radio power stations scattered throughout the future city. To obviate the inverse square loss which causes such a weakening of the radio wave for power purposes, Mr. Corbett suggests that a large number of radio energy transmitters and their associated antennae can be scattered systematically throughout a large city or other city, and also along airplane routes in suburban sections.

Automobiles will probably be built of a new metal lighter than aluminum and stronger than steel. Unbreakable glass, or rather a glass substitute, transparent to the ultra violet, and other health rays, which the sun sends us, but which ordinary window glass cuts off from us, will be used both for pleasure vehicles, boats, trains and buildings. The streets of the future city will be made beautiful by the well-planned parks, with their trees and fountains to be found on every other block, and as one looks

(*Continued on page 776*)

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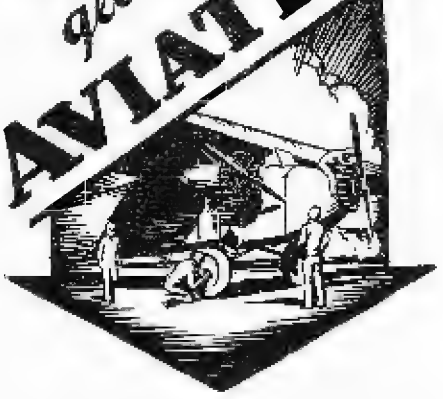

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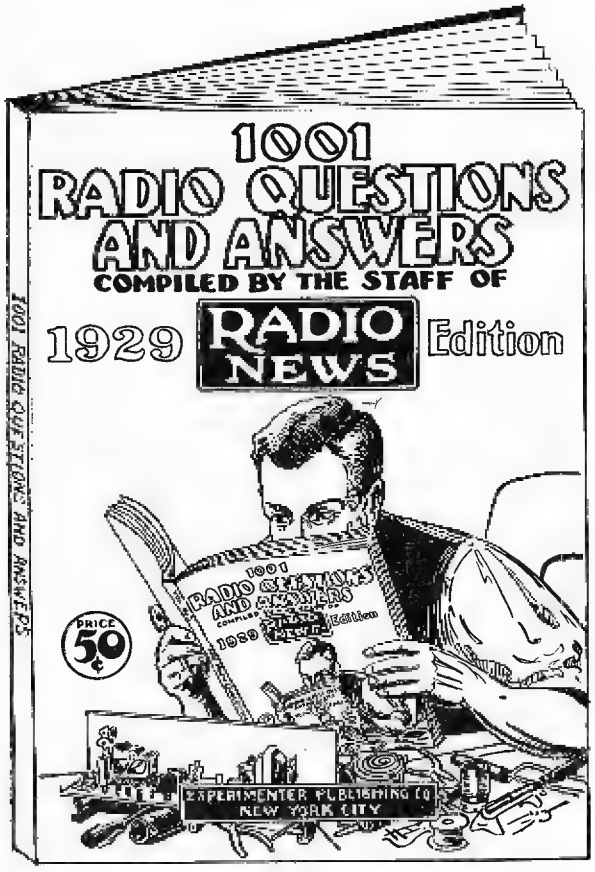

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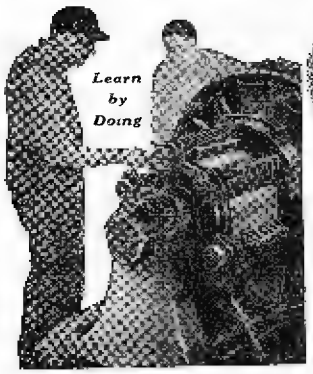

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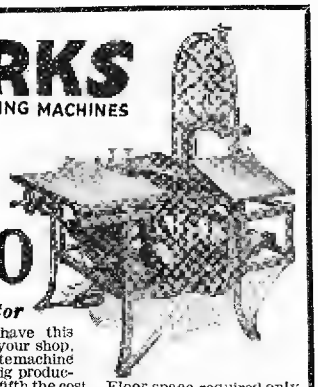

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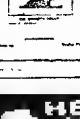

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Wood Turning

By H. L. Weatherby

(*Continued from page 721*)

is all that could be desired by anyone.

The stock for the handles desired should be cut square or rectangular in shape, slightly larger in cross-section that the major diameter of the ellipse to be made, and two or three inches longer than the finished handle is to be. The material chosen will probably be hickory.

The usual centers are located and marked. The location of the other centers will determine the nature of the ellipse and the drawings will serve to make their location a simple matter. Through the exact center draw perpendicular lines across each end and connect the ends of these two lines with lines drawn lengthwise down each of the two opposite faces, marking the ridge of the oval.

Next mark the two off-centers on each end very carefully and with a ⅛" drill make holes at these points and at the exact centers also to accommodate the lathe centers.

After these have been marked and drilled, place the block in the lathe on corresponding off-centers and with gouge and chisel turn one side. Now with other off-centers turn the opposite side. This work should be done with the lathe running at medium or slow speed. Next, with the piece on exact centers take a light cut, removing the ridge and forming the elliptical shape. When this has been done, work the handle to shape, changing the centers as necessary. The work can be sanded and polished in the lathe or it can be oiled and polished by hand if desired. The head end will of course have to be shaped with plane and spoke-shave to fit the tool for which the handle is being made.

Next month we expect to present split work, showing the methods used in turning half columns with drawings for a chest decorated with turned work.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

of Science and Invention, published monthly at New York, N. Y., for Oct. 1, 1928, State of New York, N. Y., County of New York, N. Y., ss.

Before me, a notary public in and for the State and county aforesaid, personally appeared Hugo Gernsback, who, having been duly sworn according to law, deposes and says that he is the Editor of Science and Invention, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse side of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Experimenter Publishing Company, Inc., 230 Fifth Avenue; Editor, Hugo Gernsback, 230 Fifth Avenue; Managing Editor, H. Winfield Secor, 230 Fifth Avenue; Business Manager, Alfred A. Cohen, 230 Fifth Avenue.

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3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

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H. GERNSBACK,
Editor.

Sworn to and subscribed before me this 28th day of September, 1928.

JOSEPH H. KRAUS,
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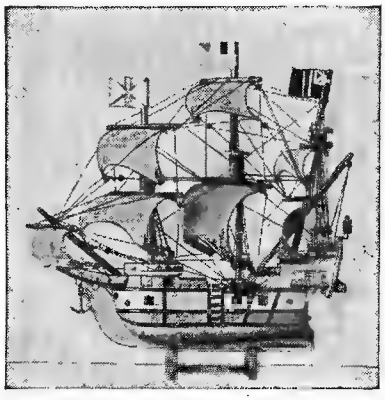

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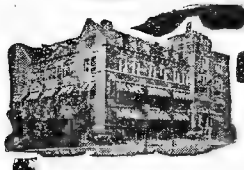

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Cities of Tomorrow

(*Continued from page 773*)

skyward in any one of the streets, his eyes will be greeted by systematical rows of balconies or promenades, the rails lined with shrubbery and other growing plant life. As the pictures show, the upper group of fifteen or more stories in which the city residents would make their homes, would each have a shrubbery line promenade on every floor, and all of the living rooms would receive plenty of sunlight and fresh air. The sectional drawing on the third page of this article will show how this is brought about, due to the clever plan worked out by Mr. Corbett, wherein he incorporates theaters, meeting halls, churches, television parlors, art museums, etc., which will occupy the space inside or rather underneath the resident floors. The living rooms will therefore form a veneer over the outside of the amusement and other public halls.

The streets would be extra wide in the city of the future, and twelve to sixteen lines of vehicles can be easily accommodated in the design of street proposed by Mr. Corbett. Where more than one street level becomes necessary, the upper streets will be made undoubtedly of a transparent substance possessing the strength of steel, so as to transmit light to the lower levels. Of course, highly perfected ventilation schemes would be arranged for any traffic level, such as those now employed in the vehicular tunnel which passes under the Hudson River from New York to New Jersey.

The buildings in the future city will be heated possibly by electricity or else by radio power picked up on a small antenna, and a suitable meter, arranged in each apartment or store, etc., and germ-free air will be piped under the streets to the buildings, or else the air can be treated and purified in each building. Other pipes and conduits under the streets, as shown in one of the accompanying pictures, would carry water, sewage, and other commodities, some of which we probably do not even dream of today.

Three Kinds of Subways in 2028

AT least three different forms of subways are envisoned by Mr. Harvey Wiley Corbett when he talks about the city of tomorrow. The first subway we would find in descending below the street level, would be comprised of three or more moving platforms, the speeds of the platforms being graduated and running at say, five, ten and fifteen miles an hour. A person walking from a station platform onto the low-speed moving platform, could easily walk across to the medium-speed one, and thence onto the fifteen-mile-per-hour or higher speed platform, which will contain seats. These triple moving platform subways will undoubtedly be built in duplicate in order to carry the heavy traffic of such a city as New York fifty to one hundred years hence, when the population will probably be thirty to forty million people, and this form of subway would be designed to take care of local stops over distances of eight to fifteen miles, or say, from the Battery to 125th Street, in New York City. If one cared to make a longer jump, of say New York to Paterson, or Bridgeport, he would descend in the elevator to an express subway buried deeply in the ground, and here high-speed electrically-propelled, or else radio-propelled cars would whisk the passenger along at a speed of one hundred to one hundred and fifty miles an hour. He could also, of course, travel by airplane if he so desired.

The third form of subway would take the form of large pneumatic tubes, and the car-

(*Continued on page 780*)

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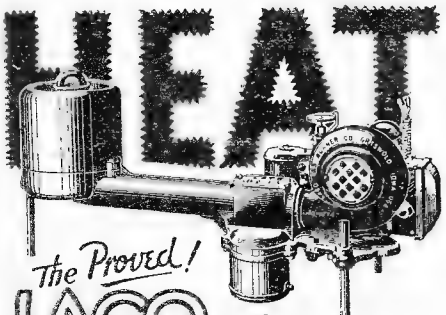

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(*Continued from page* 731)

connection, and the other two for either a long or short antenna.—*Name of manufacturer furnished upon request.*

Dirigibles and Airplanes

By Joseph H. Kraus

(*Continued from page* 701)

112 hours. Recently we note the "windmill" has flown across the English Channel. It may be remembered by some of the readers that the auto gyro of de la Cierva was originally described in SCIENCE AND INVENTION Magazine as early as in January, 1926, when it seemed to be just another bubble in the helicopter field. This machine produces very great stability, is easy to manipulate and is capable of landing on a very small space. The machine will come down to earth whether the engine stops or not without necessitating careful manipulation of the controls on the part of the pilot. The mechanism operates approximately as follows. As will be observed in the diagram, as well as in the photo, there are four blades mounted on a vertical pillar. These blades have a total area of 160 square feet, and they rotate at a speed of from 120 to 135 revolutions per minute. In bringing the plane into flight, this is the procedure generally followed: A crew of mechanics wind a wire cable around the support for the large air screw. This wire is then pulled, causing the air screw to rotate. The machine is then made to taxi around the field which causes the air screw to rotate more rapidly. As the speed increases, and arrives at about 120 revolutions a minute, the plane can be lifted practically vertically into the air. For further details regarding the auto gyro and how it operates, we refer our readers to the January, 1926, issue of this publication.

The world's largest hydro-airplane, the Roamer, made its first flight only a short time ago at Travemunde, Germany. This vessel weighs 18 tons gross, and is of all-metal construction. It is intended that it will serve satisfactorily in the trans-oceanic service between Germany and Argentina.

This machine will attain the speed of nearly 200 miles an hour when its three motors are running at full speed. The motors develop 2,400 horsepower.

This desire to increase the speed of trans-oceanic travel is also made manifest by the steamship companies.

The Ile de France has recently been fitted with a catapult. Within 12 hours' flight of Europe, a plane is placed on the catapult with its passenger and mail and is subsequently shot into the air, to resume the flight to land. This cuts down, to a great extent, the time required in making this intercontinental voyage. It must be remembered that much of the time is taken up at the two extreme ends of the voyage, where traffic conditions are rather heavy.

Even air advertising comes in for its improvement. There is a new system for advertising directly from a plane which employs a number of lettered flags suspended from a cable and drawn along by the plane in flight. In the photographs illustrating the article, we find the pilot of a German plane has fitted a chute to the bottom of the fuselage into which the lettered banners are drawn and from which they are released. Alongside of the pilot there is a crank communicating with the drum on which the cable is wound. The flags are attached to the cable and each is initialed. A weight is hung from the bottom of the cable to hold it in a substantially vertical position.

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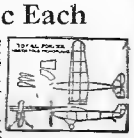

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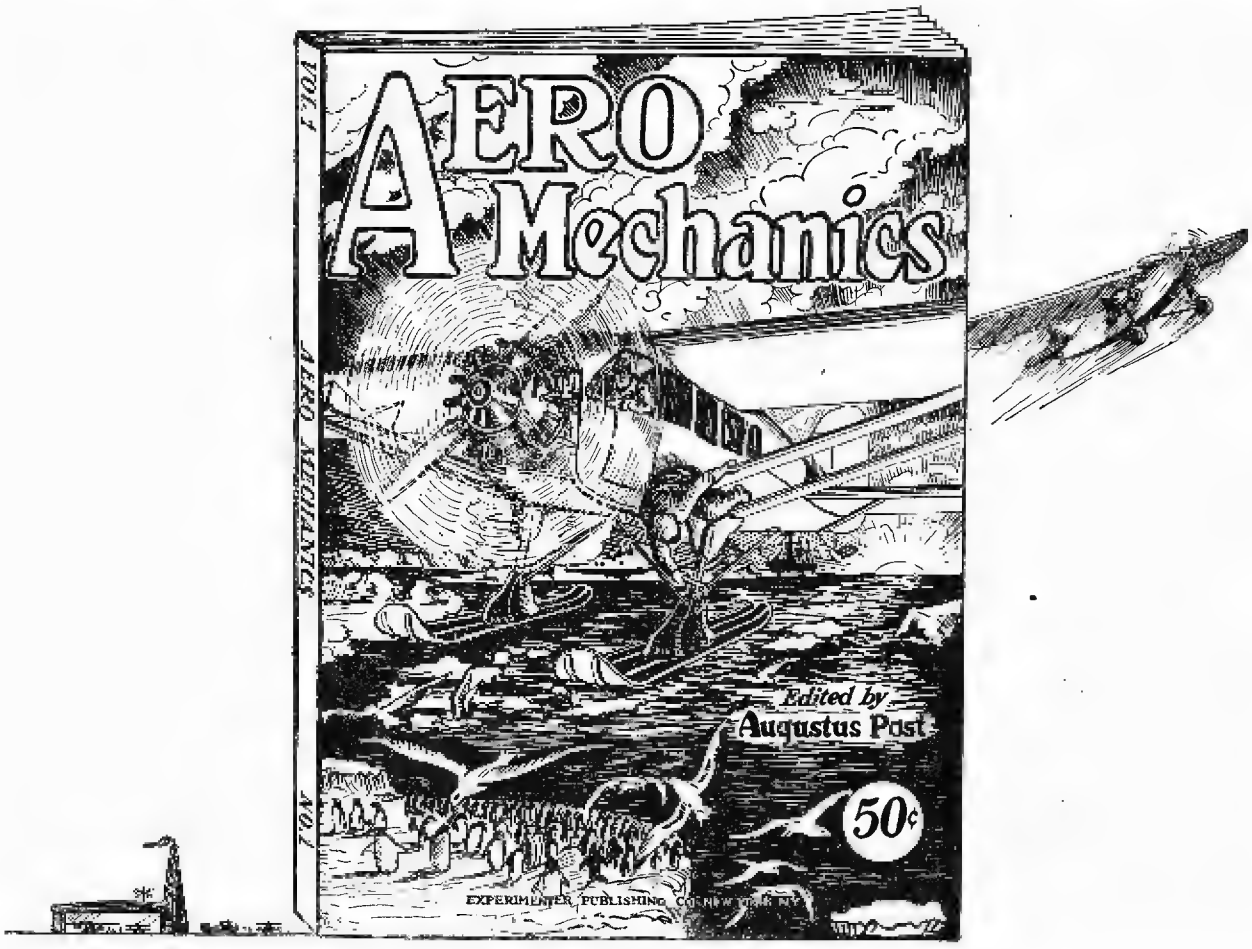

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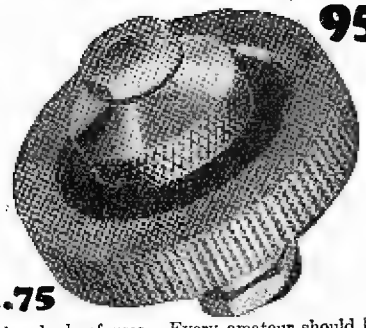

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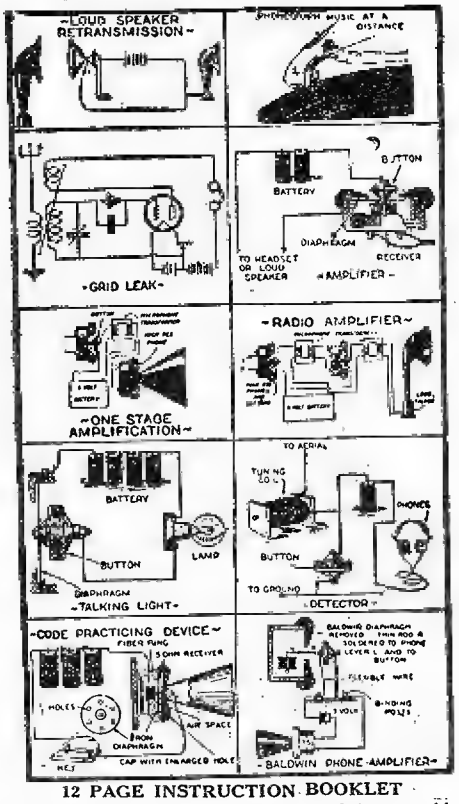

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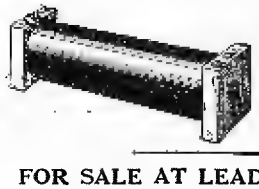

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City.....State.....

Simple Scientific Experiments

By Raymond B. Wailes

(*Continued from page 717*)

in the bottle. A small quantity of air will cause the experiment to fail.

Sound waves should be tuned with their sounding chambers much as we tune our radio sets. A wide mouthed vase containing no water will perhaps emit no sound when a vibrating or ringing bell is held at its mouth. By adding water to the vase, the air column within can be so adjusted that the sound waves will "match" the air chamber, or be "tuned" to it, so to speak.

An iron pipe can be made to give forth a musical note when the air within it is set into vibration. One manner in which the air can be made to vibrate is by thrusting a jet of burning gas into the pipe. Usually the gas pressure of the house pipes fed through a rubber tube to a medicine dropper will produce a long pointed flame which will give a fair musical note when thrust within the pipe.

Home Movies

Conducted By Don Bennett

(*Continued from page 715*)

be substituted. The fixing bath is mixed like this:

Fixing Bath

Water	½ gallon
Hypo	1 pound

Dissolve and add

Water	4 ounces
Sodium sulfite	88 grains
Powdered alum	175 grains
28% acetic acid	1½ ounces

Mix the solutions separately and pour them together.

"The film should be left in this solution until the yellow color has entirely disappeared. Then it is washed in running water for half an hour. The last step is the drying. All this time the film has not been removed from the drum. To dry, put an electric fan in front of the drum and turn it as rapidly as possible by motor.

"A word of caution about handling this wet film. When the film has been in the water a few minutes it will start to stretch and this slack must be taken up. Similarly, when it starts to dry, it will contract and the film must be loosened or it will be out of shape when dry. This would mean that the titles would jump all over the screen when projected. Before letting the film dry, run it through a chamois moistened with water. This is done by loosening the end of the film and putting the chamois pad around it, then turning the drum so that the film runs through the chamois. This is very important, as drying marks, very objectionable on the screen, will show if it has not been done.

"All that is left is to project your titles, to make sure they are perfect, and then splice them into your films.

"Me for the type method! I think there is more fun in that than in shooting the films.

"Drop in again and I'll tell you how to make fancy titles and art borders, Mr. Blake."

(Next month Blake and Jones will tell you how to make art titles, put borders on your titles, make a few trick titles, and a few more hints on the use of the title board.)

(List of manufacturers of equipment furnished on request.

WEAKNESS IS A CRIME

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many states say so when they require certain physical qualities in applicants for marriage licenses. "Physical weakness is a crime"—the United States Army and Navy say so when they put you through a rigid physical examination before enlistment. Big corporations say so, too, by insisting on higher physical standards in their employees.

THERE IS NO PLACE FOR YOU IF YOU ARE A WEAKLING!

If you are a nervous, timid, fidgeting, shambling fellow, you are not wanted anywhere — you don't attract men or women—you repel them. You can't indulge in the ordinary pleasures of life. You can't enter sporting contests—you lack the energy and stamina of the athlete. You don't get on in school or college—the fellows won't stand for your ailing and complaining, and your mental gloom. You can't hold down a good job—you are too languid and pepless. Your outlook on life is marred by fits of the blues.

Nature exacts a terrible penalty when you've gone too far with her. She whips you into such a state of debility and despair that you become a miserable specimen of a man—an object to be pitied or shunned.

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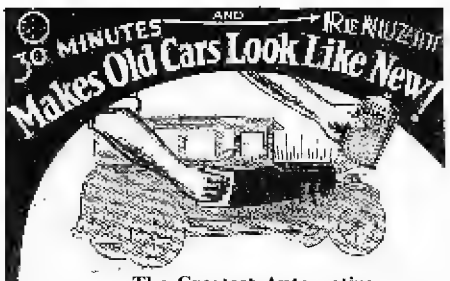

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Cities of Tomorrow

(*Continued from page 776*)

riers ten feet or more in diameter, would carry parcels, express and freight packages about the city through the various ramifications of the tube system. These express and freight carriers would operate on the same principle as the pneumatic tubes which now distribute the mail in New York City, but in the present case the carriers are small, or about one foot in diameter.

The high-speed underground subways would undoubtedly reach out from the larger cities to suburban points and even to other cities. New York City, for example, fifty years from now, or in 1978, will undoubtedly have a radius for the greater city of twenty-five miles, or a diameter of about fifty miles.

Future Airplane Traffic

HEAVIER-THAN-AIR craft, or airplanes, will be the survivor of the present contest between dirigibles and planes, in the belief of Mr. Corbett. In this conception of the future aircraft, a great many other engineers and scientists are in agreement with him. Mr. Corbett believes that the airplane, helicopter, or auto gyro craft, now proving quite successful in European tests, will be propelled by a small highly-efficient electric motor receiving its energy from an antenna system, which will intercept radio energy radiated through the ether by suitable transmitting stations. In the large picture by Mr. Corbett, shown in the first part of this article, one will note that airplanes proceed along over the future city in continuous lines or streams of traffic. We have already seen sufficient evidence given by the expert flyers in the army and navy, wherein they fly planes in "V" and other formations, so that we know planes can be flown and undoubtedly will have to be flown in continuous lines of traffic, each line of traffic in a certain direction, being at a different level. For instance, the northbound traffic would fly at 2,000 feet; the southbound traffic at 2,500 feet; the eastbound air traffic at 3,000 feet; and the westbound air traffic at 3,500 feet. Other levels above or below, but presumably higher, will be reserved for government aircraft, and certain levels would, of course, be assigned to civilian flyers. With the future design of more stable and easily controlled aircraft, particularly of the auto gyro and the helicopter type, an airplane can easily land on any of the platforms shown in Mr. Corbett's design of the future city buildings. The auto gyro type of craft designed by Cierva, can practically ascend and descend in a straight line now, and can also stop in a very short distance after landing.

The airplane of the future will be able to move along with but little attention from the pilot, thanks to the radio direction beam, which is now being used by the army and navy to quite an extent. At present, the pilot looks at an instrument in front of him, which indicates whether the plane is on a course or off it, and to which side he has wandered from the course. It is thus a simple matter for the pilot to bring the plane back on the course until the two vibrating reeds in the indicating instrument show him that he is right on the true line of flight, marked by the radio beam between two locations, such as San Francisco and Honolulu.

The future aircraft and radio experts will get together, however, and provide an automatic course steering device for aircraft, so that when the signals are properly received by a plane flying on a certain course, the signals picked up and amplified by the vacuum tube or other form of intensifier, will react on the steering controls of the plane and cause it to proceed straight along the course.

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As its name signifies, this section is devoted to the radio beginner. All the elementary principles of radio are discussed and full constructional data for the simpler sets given. Full-sized blue prints of the circuits treated are FREE.

RADIO WRINKLES

This department contains many suggestions helpful to the radio enthusiasts. Each contribution published entitles the author to a year's subscription to RADIO NEWS or, in cases where he is already a subscriber, a year's subscription to either SCIENCE AND INVENTION or AMAZING STORIES.

RADIOTICS

A humorous page of misprints contributed by our readers. For each one published $1.00 will be paid, provided that the actual article in which the misprint occurs is enclosed with a few humorous words from the reader.

RADIO NEWS LABORATORIES

In this section all apparatus awarded the RADIO NEWS LABORATORY CERTIFICATE OF MERIT in the month past is listed, and a technical description given of its purpose and characteristics.

I WANT TO KNOW

This department is conducted by Mr. C. W. Palmer. Its purpose is to answer the difficulties of our readers. The value in which the "fans" hold this section can be better realized when one considers that there are over 5,000 letters received from readers each month. Naturally only the more important ones are printed in RADIO NEWS.

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Book Review

ALGEBRA FOR SECONDARY SCHOOLS, by Eva E. Jeffs and Stephen Emery. Stiff cloth covers, 5½" x 8", 626 pages. Published by D. Van Nostrand Co., Inc., New York City. Price, $1.85.

The authors in preparing this book have endeavored to present the development and explanation of the various problems, so that the student will be able to learn much from the text of his own accord without the help of an instructor. Some subjects presented are to be studied and remembered more fully than others. Ample material has been included to meet all the requirements, the College Entrance Board, and the Regents of the Univ. of the State of New York. It is the authors belief that an extended series of logically associated facts under a few general headings is of greater educational value than learning a number of facts which have no praticular relation between them. This idea has been carried forth in the textbook. Elementary problem solving, letters, integers, rectangular solids, percentage and interest, equations, complex fractions, graphs, radicals and the like are all explained so that the student can learn to use the book rather than rely upon an outside source for showing him the method of treating these problems. A chapter of trigonometry without logarithms and a section devoted to logarithms with included table and logarithmic trigonometric computation conclude this admirable mathematical text.

MODEL AIRPLANES—How to Build and Fly Them, by Elmer L. Allen. Stiff cloth covers, 5½" x 8¼", 326 pages, illustrated. Published by Frederick A. Stokes Co., New York City. Price, $3.50.

Any boy interested in airplanes will want this book. It is one of the few which have come to our attention that includes the building of a goodly number of models and gives step by step constructional data in detail. There are two sections, one devoted to racing models, the construction of which should enable the builder to advance further and make models according to design; the second section devoted to facsimile models tells how to build replicas of many famous planes. The plans for these models have in many cases been copied and reduced to scale measurement from the actual plans of the original planes with only a few modifications necessary for a model intended for flight.

Numerous models are given, including section on the construction of a model of the famous "Spirit of St. Louis." The last chapter of the book is devoted to propeller carving and a step-by-step process in the making of air screws is given. This section like all the others in the book is well illustrated and contains plans and tables for making various sizes of propellers.—P. L. W.

THE RADIO BLUE BOOK. Stiff cloth covers, 6 x 9¼ inches, 426 pages. Published by the Radio Dealer Pub. Co., Inc., New York City. Price, $5.00.

The Radio Blue Book is issued semi-annually and contains a complete directory of the radio industry in the United States. Manufacturers, jobbers and radio set builders will find this book a handy reference. The directory has been divided into five sections, manufacturers' section, trademark and brand section, jobbers' section, manufacturers' representatives' section, and the dealers' section. All listings of products and manufacturers' are arranged alphabetically for convenience in use.

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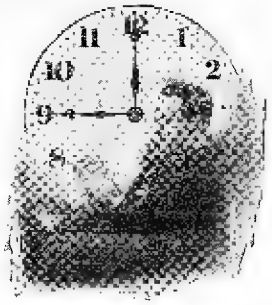

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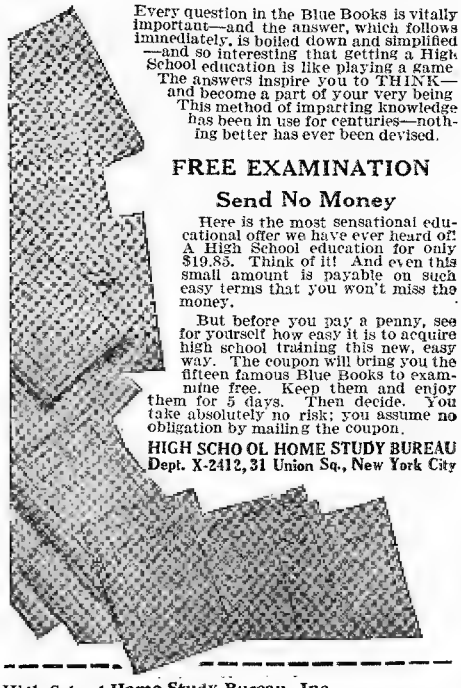

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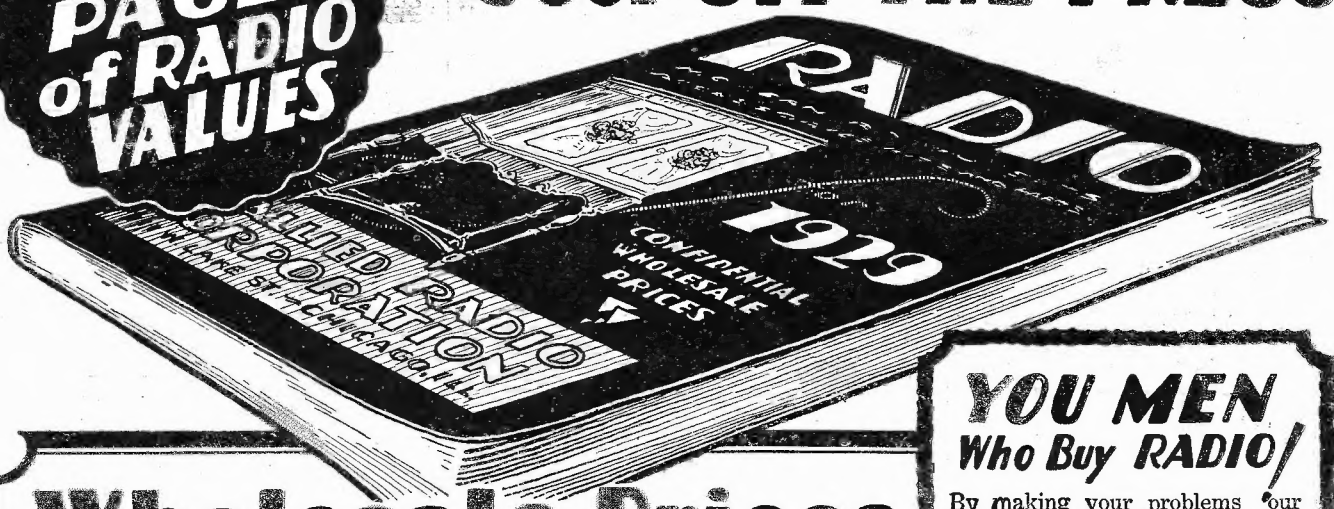

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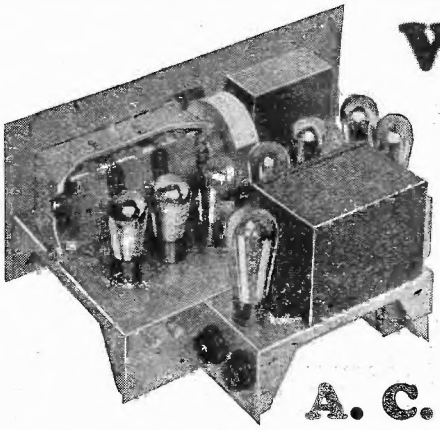

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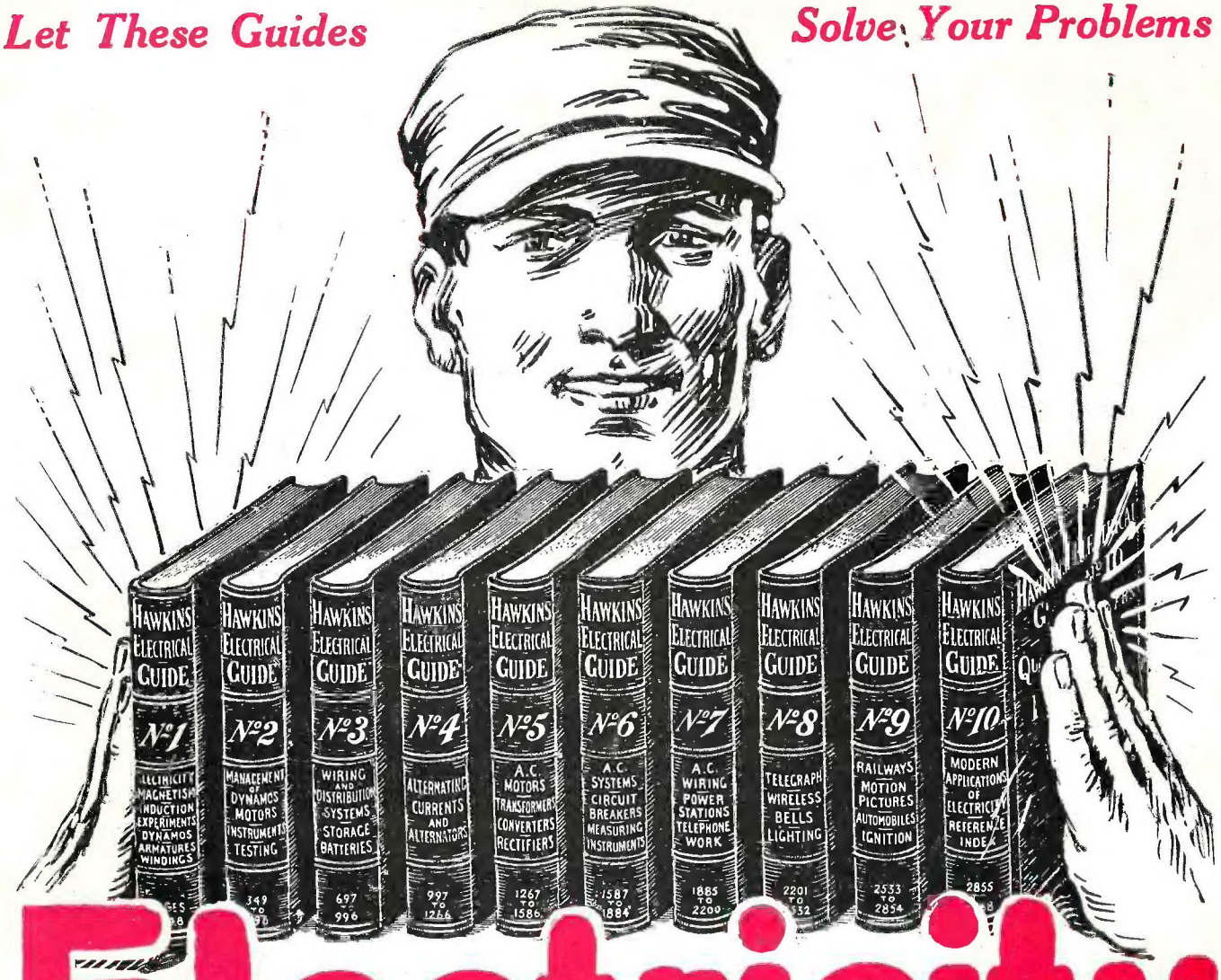

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